agriculture

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MONTHLY

At I.C.I.'s Dairy House Farm 60 zero-grazing beef animals are feeding on grass from the trough which is filled using a side-delivery forage box. See article *Zero-grazing 18-month Beef Production* on page 593

This is a picture of loose smut

This is a grain of barley like any other grain of barley except for one thing. This grain is infected with loose smut.

Drill this grain and the infection will spread up through the plant, kill the ear and infect its neighbours.

Loose smut is now rampant throughout this country and it is estimated that there were infections of up to 12% in the 1969 harvest. This is a potentially disastrous situation for future barley yields. Remedy? There is one and only one. That is to control the infection in the grain without damaging it. Hot water treatment can do it but has many disadvantages.

The modern treatment is chemical – with Murganic RPB.

Murganic RPB effectively controls loose smut.

Murganic RPB is a combined Vitvax/organo-mercury dressing which, used on seed, offers the safeguards of a mercurial dressing with positive, safe control of loose smut in both barley and wheat. And with none of the disadvantages of hot water. Murganic RPB represents a significant breakthrough in the control of cereal diseases.

Murganic RBP has been jointly developed by

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You are invited to the

AUTOMATION IN FARMING CONFERENCE

25th February 1970

SPECIMEN

This Conference is being organised by the Electricity Council, in conjunction with the Institution of Agricultural Engineers. It will be held at the Institution of Electrical Engineers in London.

The objective of the Conference will be to disseminate the latest information on automation techniques and to discuss ways and means of further developing automation in agriculture to improve productivity. Preliminary details of the programme are as follows:

MORNING– *Sessions on electricity supply and farm installations. The application and control of electric motors.*

AFTERNOON–*Automation—'A solution to the drift from the land.' General discussion.*

The Conference is intended for advisers, contractors and manufacturers, as well as farmers and all others directly concerned in modern farm engineering. Admission will be by ticket only. Tickets are available free of charge and coffee and tea will be provided. A Conference luncheon will also be available at 22s.6d. per head. Further details will be given early in January, 1970. In the meantime, if you wish to participate please complete and return the coupon without delay, as accommodation at the Conference is limited.

The Electricity Council, England & Wales.

AUTOMATION IN FARMING—CONFERENCE
To: Mr.R.E.Halliwell, The Electricity Council, Trafalgar Buildings, 1 Charing Cross, London SW1.

I shall attend the Conference as a delegate

NAME_____

ORGANISATION_____

ADDRESS_____

I shall/shall not require luncheon at £1.2.6d. per head. AF4

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Agriculture

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Clever siting and good tone makes this building a pleasant addition to the countryside

This account of the trend of thinking in the appearance of farm buildings will be of no small interest to those wishing to keep our countryside beautiful

The Disappearance of Farm Buildings

L. W. Gee

THIS year much attention has been paid to the appearance, as distinct from the efficiency, of farm buildings. It is perhaps worth wondering why and where this is leading us.

Until a few years ago a farmer could put up what buildings he liked and where he liked. His results were regarded by those who thought about it at all as eminently satisfactory. They still are. It would be unfair and untrue to say that beauty was achieved by accident but it was helped because water has only recently started to run uphill; a valley position is more sheltered and saves walking; natural materials tone in well with natural, and man-influenced, landscapes.

The present position, which is well known to those interested in farm buildings, is that for large structures, which are getting much more common, planning permission is necessary. The materials used tend to be man-made rather than natural and do not tone in naturally with the surroundings. The other big change is that most of these buildings are factory-made in standard shapes and sizes.

It is worth defining tone. It is the relationship between black-and-white of a particular colour—the lightness or the darkness of it. Similarity of tone makes for sympathy and inconspiciousness almost as much as similarity of colour. That is why a tower silo with a silvery roof on the skyline is 'good'.

It is widely and very properly felt that anything made by God must be more beautiful than anything made by man. This, in part at least, sustains the extreme view, which I have heard expressed seriously, that all buildings in the country should be made of wood and thatched. It is perhaps worth remembering that even the most artificial materials are man-made alterations of natural things and that wood—the most natural material used in buildings—would probably not be recognized as coming from trees by a Martian. Wooden buildings look so good, because they tone in, or can easily be made to tone in, with their surroundings, even trees! Wood can be treated to make it long lasting and fire resistant and will no doubt rightly remain a favourite, well able to compete with other materials for most farm uses.

It is easy to forget that time and familiarity do confer respectability. It is no longer fashionable to hack down electricity pylons. Railways have been accepted as part of the countryside for a century and their passing is regretted. When the dark, dry stone walls were first put up in long, straight lines over the Cumberland hills, did an old woman say how ugly they were? If she did, was she right?

In recent years many have reacted to actual or likely criticism by trying to hide their buildings. The crudest and simplest answer is to do it literally by planting trees round it. Like many crude simple answers it is often the best. Other ways are careful siting and colouring, but this is surely a negative approach implying almost a sense of guilt. The ideal must be to make buildings look good even when they are conspicious. A lot of people are thinking about this and doing something about it.

In six earlier Country Land Owners' Association competitions dealing with different aspects of farm buildings and fixed equipment, there was only one complaint that the judges had been unfair. In this year's competition on appearance there were several, and some were clearly hurt that something they had tried to make beautiful had been passed over. This is surely significant, and in spite of individual disappointments, encouraging.

There are people who think more strongly about beauty than utility, and resent criticism or lack of appreciation of their efforts to keep our country beautiful.

The difficulty is the combination of off-the-peg buildings, in man-made materials and of increased size, together with planning permission requirements for big buildings. The scope for differences in buildings is minimized and the scope for different opinions increased. The Planning Officer of County 'A' may like what we may call 'Agricost' buildings and approve some of them. It is expecting a lot of human nature for 'Agricost' and farmers in a different setting to sympathize with the Planning Officer of County 'B' when he reports 'the rainwater goods simply save you getting water down your neck and keep the yard dry. They do not make a positive contribution. Also, the design and position of the keyhole are irresponsible and out of sympathy with the loading platform'.

There are plenty of sources of advice. Readers of the March, 1969, issue of *Agriculture*, will have found much guidance in Mr. Weller's article. Another is *Farm Buildings and the Countryside*, obtainable from H.M.S.O. (addresses on p. 628) 10*s*. (by post 10*s*. 8*d*.). This deserves to be widely

studied and the fact that some have praised it and others have attacked it violently does not mean one cannot learn from it. It shows once again that dictation in matters of taste is an impertinence.

We must be thankful not only that we cannot all think alike, but that it is even unnecessary for us to pretend to do so. We must tolerate other points of view and others must tolerate ours. It is up to the agricultural community to put up good, economic buildings that suit their surroundings. All the signs are that both manufacturers and buyers are alive to their responsibilities. They can safely be trusted to produce good answers and should welcome official help. Private professional advice can be invaluable, even if the building is factory-made.

In his Foreword to the publication *Farm Buildings and the Countryside*, the Minister of Housing and Local Government wrote 'In the private sector, my colleagues and I acknowledge with gratitude that much of the beauty of the countryside has been created willingly by the farming community and we hope that this will long continue to be the case'. This may not be the most important event since the Creation but it is surely a very advanced piece of forward thinking. The Minister wrote, too, 'In addition, I trust that farmers will co-operate with local planning authorities in discussing with them the siting, design and external appearance of both new buildings and also alterations to existing ones, especially if they are within National Parks and Areas of Outstanding Natural Beauty'.

To sum up, therefore, let us discuss, we can all learn. In our society this is far more effective than having to seek permission.

The article has been contributed by **L. W. Gee, F.C.C.S.** who is Assistant Secretary to the Country Landowners' Association, and Secretary to its Farm Buildings Sub-committee.

The photograph on p. 581 is a grain storage building by W. H. Smith & Co. (Whitchurch), Shropshire. The building which is 300ft long, 70ft wide and 18ft high is roofed and clad with Big Six (grey) asbestos cement sheets over 6ft high sheet steel thrust-resistant walling on sides and ends.

The clever siting and good tone make this huge building a pleasant addition to the Peebleshire landscape.

Dried Peas

In the October issue of *Agriculture* an article by G. P. Gent on dried peas included a map (p. 495) with a statement that unshaded areas 'averaged 2 inches or less rainfall per month during July and August'. This was a misinterpretation of data by the author and should have read 'averaged 2–3 inches per month during July and August'.

The implications of the map, however, are unchanged, namely that it should be possible to grow dried peas in the areas indicated.

Back row (L. to R.) *Cheddar, Cheshire, Stilton, Wensleydale*
Centre row (L. to R.) *Leicester, Lancashire, Double Gloucester*
Front row (L. to R.) *Derby, Caerphilly*

British Cheeses

Kathleen Maddever

THE making of cheese is a very ancient craft. In Biblical times David was fed with 'cheese of kine' and one can readily imagine the nomadic tribes of the East having little problem (in that warm climate) to produce a curd from the milk of their camels, asses or goats.

In this country, cheesemaking started as a farmhouse industry and as a craft has been known for many centuries. There is many a legend about the first cheese ever made, and that of the shepherd boy who lost his can of milk on the Cheddar Cliffs is as good as any; for when he found the can six weeks later, it contained an edible solid! Likewise, there are claims to the oldest variety of cheese known in this country and on this score Cheshire seems to have beaten Cheddar.*

A writer called Tusser in 1557 instructed his dairymaid, Cisley, on 500 points of good husbandry and anyone who knows anything about cheese and cheesemaking will readily recognize that he was warning against the problems which are still common in cheesemaking today, for example,

*'A bit o' Cheshire.' *Agriculture* Vol. 71, No. 5. May, 1964.

Too salty	'Leave Lot with his pillar, good Cisley, alone, much saltness in whitemeat is ill for the stone'
White and dry	'Gehezie his sickness was whitish and dry Such cheeses, good Cisley ye floted to nie'*
Gassy	'If cheese in dairy have Argus his eyes Tell Cisley the fault in her huswifery‡ lies'
	'Thus Dairymaid Cisley rehearsed ye see, What faults with poor huswife in dairy—housebe, At market abhorred, to household a griefe To master and mistress as ill as a thiefe.'

A writer called Fuller complains that in 1650 cheese was so dear that it was found only on the tables of the rich. How much happier for the consuming public when cheese, one of the best protein foods, is available at a price cheaper than meat, having regard to its food value.

Since sheep were much more numerous than cows (or milch kine) their milk was extensively used for cheesemaking. Only small numbers of cattle existed up to the end of the seventeenth century, there being no scope for enterprise since the Manorial Courts settled the number of cows to be kept on 'the open field'. In the eighteenth century, large-scale enclosures and redistribution of the open arable fields and waste lands made it possible for the farmer to segregate his cows from the village herd.

In 1784 it was written that Cheshire farmers kept vast herds of up to 100 cattle and at that time a herd of 20–30 cows was called a 'large herd'. It would be interesting to know what our ancestors would say of the intensive herd management of 1969, with many farms having one cow to an acre and a few herds with as many as 300–500 cows.

In Britain, we have what are known as territorial varieties of cheese each having taken its name from the area in which it was first manufactured, e.g., Cheshire, Cheddar, Derby, Dunlop, Leicester, Wensleydale, Caerphilly, Double Gloucester and Lancashire. Blue-veined varieties are few and comprise Stilton ('the King of Cheeses' made mostly in the Dukeries), Wensleydale (Yorkshire) and Blue Viney (Dorset).

Cheesemaking is an excellent method of preserving most of the important constituents of milk in edible form. Most of the hard and blue-veined cheeses are at their best after 4–9 months maturing.

There have, however, been several soft and cream cheeses made in recent years, notably Cambridge (or York), Colwick and single and double cream cheeses. None of these has a long keeping quality, very largely because of their high-moisture content.

Principles of manufacture

Cheese curd is made up of fat protein, water, salt and traces of other minerals. The essential differences between the several varieties of cheese are due to adjustments in the level of moisture and acidity in the finished cheese, and to the rate at which this acidity is allowed to develop. Some cheeses are coloured traditionally and a vegetable extract called annatto is used.

*Skimmed too much. †Dirty utensils and dairy.

Rennet. In the earliest methods used to form a curd, either acid conditions were allowed to develop naturally and coagulated the milk, or the juices of plants were used. Having discovered that the stomach of a suckling calf always contained curd, the lining of the stomach (called a vell) was cleaned and dried, and when small pieces of it were soaked in water, the resulting liquid was found to have the ability to coagulate milk. Cheesemakers up to about 1900 used these vells, but later the enzymes contained in the skin were extracted, purified and standardized for strength and sold as rennet. Because of the rising cost of rennet at the present time, some cheesemakers are using a 50/50 rennet, i.e., part vegetable and part animal extract.

Starter. With the introduction early in this century of carefully prepared pure cultures of lactic acid bacteria, the process of cheesemaking has been shortened, because makers no longer depend on natural acid development. Nowadays whey is separated after being drawn from the vat, because whey particles have been shown to harbour a type of virus known as 'bacteriophage' which can destroy lactic acid bacteria, a system of aseptic starter preparation has been devised. Traces of antibiotics used in the treatment of mastitis, which may carry over to the milk used for cheese-making, may also totally inhibit the acid-producing bacteria. Until early this century, cheesemakers relied on smell and taste to ascertain the level of acidity. More sophisticated titration methods are now common, yet one of the most reliable tests is still the 'hot iron' test—one that has been used for generations.

Mechanization. Due to the current labour shortage, as much of the cheesemaking process as possible has been mechanized. Now, cutting is mostly done by knives affixed to the paddles. Mechanically-driven paddles do all the stirring while 'scalding' is in progress. There are a few automatic salting machines in use.

A continuous cheesemaking process has been developed by the National Institute for Research in Dairying, but how far such a departure from traditional methods will affect the quality of the finished cheese has yet to be proven. There is, however, world-wide interest in such a system.

Most varieties of cheese are made from mixed evening and morning milk. The bulked milk is heated to 70–75°F and then starter is added. As

Milk containing starter is treated with rennet and the curds and whey are stirred automatically in the cheese vats

After being transferred to shallow cooling vats the whey is drawn from the curd. Pieces of cut curd can be seen travelling along the conveyer belt

soon as enough acid has developed, rennet is added to the milk to form a coagulum. After 30–40 minutes the coagulum is cut, so that small particles of curd are floating in the whey which comes out of the coagulum. Heat is then applied slowly to the curds and whey and the 'scalding or cooking of the curd' to a temperature of 92–104°F (depending on variety) is done slowly, taking about 40 minutes to 1¼ hours. The whey is then run from the making vat by which time the curd particles have matted together. The curd is cut into blocks and/or strips for further cutting, breaking, piling and turning. The heat and weight of the curd in the pile changes the fibre structure of the curd; at the same time acidity is increasing and moisture content decreasing. When the curd has sufficient acid and is dry enough it is milled, salted and packed into moulds for pressing. The length of time taken from renneting to vatting will vary widely, e.g., with Caerphilly two hours, with Cheshire Cheese this would be three hours, with Cheddar five hours.

Pressing. Gang presses, where the cheeses are placed in line horizontally are now common, replacing the very old stone weighted presses and upright double lever presses. The gang presses may have pneumatic 'heads' so that even pressure on the cheese may be maintained. Vacuum presses are now frequently used—the withdrawal of air from within the cheese resulting in closer texture.

Packing. The most significant change in the cheesemaking and ripening process has been the introduction of rectangular moulds (for several varieties) and the use of film in which the cheese is wrapped. Ripening 'in film' demands considerable adjustments in manufacture; the curd must be firmer and have less moisture than that produced in the traditional way where cloth, with or without grease or paste, form the protective outer bandages during ripening.

Types of cheese

Cheshire cheese. A Cheshire cheese should possess a clean, mild flavour, have a firm and full, but not hard, body with a free granular and silky texture. The cheese may be white or coloured—but in either case the colour must be uniform. (13 in. high, 11 in. across weighing about 50 lb, but 40 lb, 20 lb and 1 lb midgets are available).

Cheddar cheese. Normally pale-straw coloured, it should be clean and mellow in taste, close textured, firm, yet smooth when pressed between finger and thumb, and leave a smooth coating of cheese on the 'cheese trier' or 'iron' when bored; this denotes maturity and quality. (Normally 50–60 lb in weight, but 'truckle' Cheddars weigh 10–12 lb).

Caerphilly. This cheese with a high-moisture content should have a clean, mild flavour, be of firm but not hard body, short texture and white colour. It is often sold at 5–6 days after making, having been brined in a 20 per cent solution for 24 hours. (4 in. high, 9 or 10 in. across, weighing 9 lb).

Double Gloucester. May be coloured or uncoloured. The flavour should be mellow and mild, texture close, with firm yet smooth body. This cheese should be matured for 4–6 months (4 in. high, 11½ in. across weighing 35 lb).

Derby. This cheese has a high-moisture content and can readily develop over acidity; its characteristic flat shape means that too rapid evaporation of moisture may lead to a cracked coat. The cheese should be mild in flavour, leafy-textured yet firm bodied (5 in. high, 14 in. across and weighing 30 lb).

Sage is commonly added to layers of curd throughout the cheese to produce a green colour and strong flavour.

Dunlop cheese. Essentially of Scottish origin although in many ways similar to Cheddar, it is more smooth, close and even textured and should have a creamy, mild flavour.

Lancashire cheese. A cheese made by the mixing of two or three curds which are 12 and 24 hours old. The finished cheese should be clean, mellow and mild with a soft, crumbly texture yet be firm enough to retain its shape. It is an excellent toasting and cooking cheese (8 in. high, 13 in. across weighing approximately 45 lb).

Leicester cheese. A good cheese should have a full, clean flavour and a fairly open and short texture. It should be of uniform and deep 'red' (annato) colour. (Traditionally 18 in. in diameter, 4 in. deep and weighing 30–40 lb).

Stilton. Widely known as 'the King of Cheeses'. This variety is sold white or fully matured blue-veined. The latter has a distinctive flavour, and should be creamy and mellow when mature. The cheese is not normally bandaged but the outside is lightly scraped to seal the coat which will form in three or more days in the cool, damp, airy conditions of the 'coating' room (9 in. high, 8 in. across and weighing about 14 lb).

Wensleydale. Traditionally a blue-veined cheese it is now usually sold as a white cheese. It should have a mild, slightly acid flavour, be soft and flaky in texture (6 in. high, 8 in. across, weighing about 10–12 lb).

Dorset Blue Viney. The only territorial variety traditionally made with part skimmed milk. A fairly strong flavoured blue cheese with fairly dry, short texture. Traditionally very difficult to 'blue'.

Methods of marketing

Farmhouse cheese is still made in Cheshire, Somerset and S.W. Scotland and most of this is marketed in traditional shapes and wrappings. However, much of the creamery cheese is now pressed in the New Zealand rectangular moulds. The 40 lb blocks may be matured as a whole, then cut into 10 lb

blocks which are easy for the grocer to handle. Block cheese is normally film wrapped and, since it matures in the absence of air, considerable adjustments in the making are necessary in order to reduce the moisture content of the curd; otherwise the ripened cheese may have a flavour and texture not characteristic of the territorial variety.

Nowadays, more and more mature cheese is packed in consumer portions for the supermarket.

After serving with the agricultural education staff of the Somerset County Council for fourteen years, the author of this article, **Miss K. D. Maddever, O.B.E., N.D.D.,** joined the National Agricultural Advisory Service on its formation in 1946. She is now the Regional Dairy Husbandry Adviser for the South Western Region.

HORTICULTURE

The use of cloches in certain circumstances mean earlier production and additional income with little, if any, extra labour

J. E. Heath

Cloches and Polythene Tunnels for Vegetables

CONTINUOUS cloches have been used for many years in horticulture. During and immediately after the war they were used in many areas for vegetable growing, but as soon as emergency conditions were over the majority of growers changed to strawberry production. In the Vale of Evesham, however, vegetables are still the most important cloche crop and instead of the acreage declining as in most districts, the area of vegetables grown under cloches has increased over the last five years. At present it is estimated that over 60,000 yards are in use for vegetable production in the Vale compared with 20,000 yards in 1964.

The only type in general use is the Growers' Barn which is approximately 24 inches long by 23 inches wide with a height of 9 inches at the eaves and 16 inches at the ridge.

Vegetables have remained popular in the area for a number of reasons, but mainly because the Vale is essentially a vegetable growing area and the crops best suited to cloche growing were already being produced in the open. The growers are therefore skilled in the production of such crops as radish, runner beans, lettuce and marrows and there is a known market for these crops. The use of cloches in such circumstances merely means earlier production and additional income is possible with little, if any, additional labour.

Production under cloches is almost entirely in the hands of growers with less than 20 acres of land, often employing little labour other than casual labour for harvesting.

The basic cropping for the area in the past has been radish, followed by runner beans, but in the last two years the returns received for radish have been declining. Many growers are turning to lettuce as an alternative and in some cases marrows are grown instead of runner beans. The use of these rotations means that the cloches are only in use from January to June, being stacked for the remainder of the year.

A few growers have tried tomatoes, with little success and most are of the opinion that it is better to stack during the summer months. More growers are, however, becoming interested in autumn crops such as lettuce, salad onions and parsley, but if these are grown they must not be allowed to interfere with the main crops.

The most usual method for a two crop rotation is to set out the cloches in single rows 5 ft 8 in. apart with an extra foot every third strip to allow for stacking the cloches when not in use. This arrangement allows the cloches to be moved easily from one crop to another and also allows small mechanical cultivators to be used. When not in use the cloches are stacked on end on black polythene to prevent weed growth and mud splashing.

Cultural details for crops in the Vale of Evesham
Spring and early Summer crops

Crop	Varieties	Sowing or planting date	Period covered	Period harvested	Spacing
Spring lettuce	Hilde, Suzan, Attractie	February (P)	Feb–April	May	2 rows 9 in × 9 in.
Radish	French Breakfast	Jan–Feb (S)	Jan–March	March–April	7 rows/cloche
Marrow	Early Gem Emerald Cross	Late April (P)	April–May	June–July	One plant per cloche
Runner bean	Kelvedon Wonder Kelvedon Marvel	Early April (S)	April–May	July	2 rows 8 in. × 8 in.
French beans	Masterpiece The Prince	Early April (S)	April–May	July	2 rows 8 in. × 8 In.

Autumn and winter crops give variable results as they depend so much on weather conditions. The crops listed at top of p. 591 are given as examples of possible catch crops, but they should not be allowed to interfere with the main spring and summer cropping.

Most growers agree that the minimum number of cloches needed to make up an economic unit is 1,000 yards run, and preferably at least double that quantity. From 1,000 yards using a two crop rotation such as radish/runner beans or lettuce/marrows the returns are likely to be in the region of £500 to £750 with costs (including labour and depreciation) of from £250 to £350.

Crop	Varieties	Sowing or planting date	Period covered	Period harvested	Spacing
Autumn lettuce	Amplus Avondefiance	Mid-August (S)	Aug–Nov	Oct–Nov	2 rows 9 in. × 9 in.
Parsley	Extra Moss curled	Late July	Oct–March	Nov–March	2 rows 9 in. apart
Salad onions	White Lisbon Winter Hardy	Early August	Nov–Feb	Dec–Feb	2 rows 9 in. apart

Polythene tunnels have been used commercially in the Vale since 1964 when less than 1,000 yards was used on runner beans. It is estimated that in 1969 100,000 yards has been used to cover vegetable crops, the main crop being runner beans, but marrows, radish and lettuce are also being grown on a reasonable scale.

Most growers use a tunnel approximately three feet wide made of 150 gauge polythene film, supported on 8 gauge high tensile wires (50 ton/sq. in.) spaced at about 3 ft apart, and secured by polypropylene baling twine. It is not my intention to describe fully the method of erection as this has been covered extremely well in Ministry of Agriculture, Fisheries and Food Short Term Leaflet No. 78. *Continuous Polythene Tunnels for Early Strawberry Production* obtainable from N.A.A.S. horticultural advisers, or the Ministry of Agriculture, Fisheries and Food, (Publications) Tolcarne Drive, Pinner, Middlesex.

If the tunnels are properly erected and the area is reasonably sheltered they should resist damage by winds, but most growers in the Vale of Evesham bury the sides of the tunnels with soil. This is done by means of a small ridging plough in many cases.

The first users of tunnels in this area were mainly cloche growers but the relative cheapness of the method and the advent of mechanical methods of laying the polythene has allowed a greater number of the larger growers to use polythene than has been the case with cloches. Because of the connection with cloche growing in the early days most of the crops and methods used have been similar to those for cloches. This is now changing rapidly and there is a completely different outlook. Some small growers still use the polythene to cover two crops such as radish and runner beans, but in most cases only one crop is covered, new polythene being used each time. Up to now only spring and summer crops—mainly lettuce, radish, runner beans and marrows—have been grown, but many growers are now trying such crops as turnips, beet, sweet corn and peas for summer and are contemplating growing lettuce, salad onions and parsley in the autumn. It should be borne in mind, however, that most of the crops grown have a high labour requirement for harvesting and need to be presented properly if the best returns are to be obtained.

Much less information on suitable varieties, spacing etc., is available for tunnels than for cloches, but in general crops will be similar for yield and quality but will usually be later. There is also a greater risk of frost damage under polythene and most growers sow runner beans 7–10 days later under polythene to allow for this. Humidity is also higher under polythene, this does not normally cause trouble in spring and summer (indeed it is sometimes

an advantage) but could be a problem for autumn crops of lettuce and salad onions.

Weed control can be a problem both for cloches and tunnels, growers at present use the same materials as they use in the open but results are disappointing (e.g., Dinoseb on runner beans) often because of low temperatures early in the season. Growers in the Vale are looking to the Experimental Horticulture Stations for guidance on the most suitable materials to use for pest, disease and weed control under polythene. Preliminary trials are being carried out and results are awaited with interest.

Because of the slightly later crops obtained from polythene, returns are likely to be lower than from cloches although the costs will be similar. The return per 1,000 yards of polythene from runner beans is likely to be £200–£300 for a cost of approximately £150. Capital outlay is much lower however, £50–£60 per 1,000 yards for tunnels compared with £560 for cloches. Many small growers, however, feel that cloches are safer and if capital is limited buy polythene to make enough money to purchase cloches.

What of the future? It is certain that if growers with a limited acreage are to survive they must either increase their acreage or intensify. In many cases intensification is the only possibility and cloches and polythene are a reasonably cheap method of doing this.

Cloches for vegetables in this area have probably almost reached their limit, but polythene tunnels are likely to increase in the next few years. The demand for high quality early crops is likely to continue but growers must pay attention to detail in the erection of tunnels, and growing and marketing the crops.

Much interest is being shown in the larger 'walk-in' type of tunnel now being used at some Experimental Horticulture Stations and these could be of particular value to specialist growers who wish to provide continuity of crops such as lettuce.

For the larger grower, mechanical methods of laying polythene has made the system more attractive and no doubt there will be an increase in this type of production. The grower who is likely to be most successful, whether large or small, is the one prepared to pay attention to detail, especially in erecting the tunnels and marketing—it can be a soul destroying job retrieving ten acres of polythene from a neighbour's holding!

An article on polythene tunnels for fruit will be published in a future issue of Agriculture

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The 1969 Royal Smithfield Show and Agricultural Machinery Exhibition will be held at Earls Court, London, from 8th to 12th December (inclusive).

B. Livesey

Zero-Grazing for 18-month Beef Production

MENTION zero-grazing to most farmers and the response will be something like 'that's the last thing we want to do' or 'winter muck problems all the year round'. However, the technique is beginning to gain acceptance among farmers with large dairy herds, and trials at two of the I.C.I. Development Farms are showing that zero-grazing should not be dismissed out-of-hand as a system of managing beef cattle.

Two of the most important factors affecting the profitability of an 18-month beef enterprise are stocking rate and daily liveweight gain per head. During the winter fattening period of the animal's life it is relatively easy to increase the stocking rate substantially and still achieve a satisfactory liveweight gain. One acre of good grassland fertilized with 100 units of nitrogen and cut twice for silage will yield sufficient material to support two fattening cattle. Increase the nitrogen usage to 250 units, take three cuts and the same land will support three and a half cattle. In each case a daily liveweight gain of 1·8–2 lb per day will be achieved when the silage is supplemented by an average of 6 lb of mineralized rolled barley per beast per day.

The picture is rather different, however, during the period at grass and although beef cattle are being managed successfully at high stocking rates supported by 250–300 units of nitrogen, experience has shown that they are more susceptible to the effects of the high stocking rate than, for example, dairy cows. This is probably due to fouling and to parasite problems particularly after mid-season.

Work at Jealott's Hill Farm in Berkshire and Dairy House Farm in Cheshire has indicated that zero-grazing offers a useful method of overcoming some of these problems, and has the potential to allow a very high stocking rate to be combined with a satisfactory individual animal performance.

Zero-grazing is the system of havesting grass mechanically, usually with a forage havester, and feeding it to cattle that are either housed or confined

to a small area of ground. It was examined first by I.C.I. in 1957 when a series of trials was started at Jealott's Hill aimed mainly at measuring the extra efficiency of utilization that zero-grazing offered over conventional paddock-grazing. Little attention was paid to the ability of the system to support very high stocking rates. Grass was cut with a flail harvester, transported in a conventional silage trailer and then hand-forked into a feed trough. The cattle, Hereford and Shorthorn steers, were housed in a small open yard. In these trials, grass was cut at the grazing stage and it was found that zero-grazing resulted in a very slight increase in daily liveweight gain per head. Indications were that stocking rate could be increased by 8 per cent.* These results were not very promising and because of this the trials were terminated in 1959.

Interest was renewed in 1966, and Alec Hood, now manager of The Leaths, the I.C.I. Development Farm at Castle Douglas in South-west Scotland, who had carried out the earlier work, started a new series of trials at Jealott's Hill. Two important changes were made from the previous trials:

1. The objective was to assess the potential of zero-grazing as a tool for increasing stocking rate.
2. The grass was cut at a much later stage of growth, in fact right up to ear-emergence.

It was known from small-scale cutting trials that within certain limits the total yield of grass decreased as the number of utilizations was increased. In the context of a conventional grazing system, this finding was of little value as it was unrealistic to think in terms of grazing a highly fertilized field only four times in a season. The trials were, therefore, aimed at finding out whether the use of grass cut at a much later stage of growth would allow an increased stocking rate to be achieved and, more important, whether young cattle were capable of using this relatively mature grass efficiently.

Batches of beef cattle have been zero-grazed at Jealott's Hill each year since 1966 and trials were started at Dairy House in 1967. At both farms grass is cut twice per day with an in-line flail forage harvester, and fed using a forage box which discharges the grass into a trough or behind a feed fence. Fields are cut from side to side and fertilizer is applied whenever approximately one acre has been cleared. Under the high nitrogen regimes being used, swards of Italian ryegrass, S24 perennial ryegrass and S170 tall fescue have all been successful.

On both farms zero-grazed cattle are housed in cubicles bedded with sawdust and this has reduced the cost of all-the-year round housing. Over 450 cattle have now been zero-grazed and the results of the trials have, on the whole, been very encouraging. Although the average liveweight gain per head has tended to be about 7 per cent lower than that of paddock-grazed comparison groups, stocking rate has been 25 per cent higher. Details of two trials which gave some of the best results indicate the potential of the system.

At Jealott's Hill in 1967, twenty-seven pure Friesian steers were maintained, from purchase at 306 lb live weight in early March until sold fat approximately twelve months later, on grass and silage from eleven acres. Zero-grazing started on 28th April and four cuts of grass were taken with intervals of fifty-two days, forty-one days and forty-three days between successive cuts. The D value (percentage digestible organic matter in the dry matter) of the zero-graze material fluctuated within the following range:

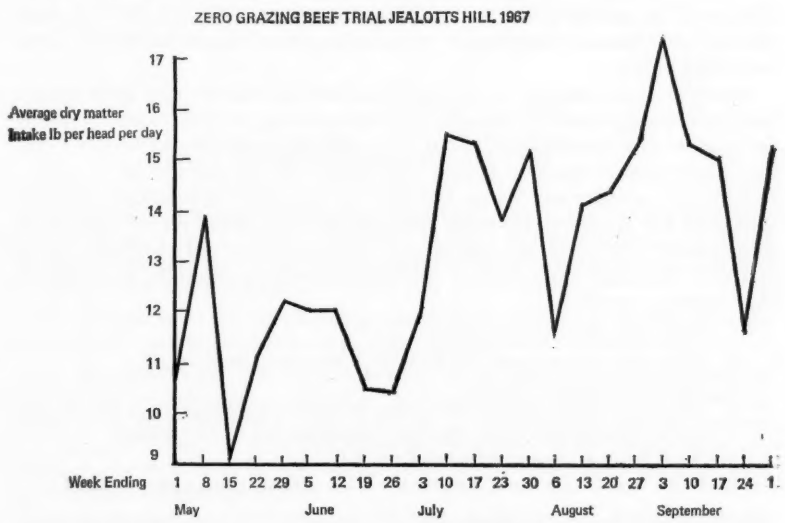
*Hood, A. E. M., (1962) J. Brit. Grassl. Soc. **17**, 264-7.

	D Value	D.M. % Range	C.P. % Range
April-May	76·8–70·2	14·8–21·7	10·6–20·5
June	70·7–57·0	12·9–28·9	7·2–15·7
July	62·5–52·7	18·5–25·5	8·3–20·5
August	65·2–61·6	13·8–22·8	14·1–23·4
September	68·1–55·9	12·1–24·1	15·3–22·7
October	64·3	13·5–18·5	16·9–20·1

Despite quite wide fluctuations in D values and occasional drops below D60, liveweight gains were satisfactory.

Average weight at start of zero-grazing	27.4.67	360 lb
Average weight at start of winter feeding	6.10.67.	681 lb
Average daily liveweight gain	27·4–6·10.	1·98 lb/head

Intake of grass during the grazing season varied as follows:



		per head £ s.	
Output			
	Sales price	89 3	
	Calf Subsidy	10 5	
	Less calf price	35 0	£64 8*s.*
Variable costs			
	Feed	16 15	
	Bedding	4 12	
	Vet. and medicines	5	
	Forage costs	8 16	
	Miscellaneous	10	
			£30 18*s.*
	Gross margin per head		£33 10*s.*
	Gross margin per acre		£80 12*s.*

Only 5 per cent of the total grass offered was wasted. The cattle were fattened on silage and rolled moist barley and sold fat in the spring of 1968 grading A.21, B+ 2, B− 1, C 3. Financial results are shown at the bottom of p. 595. Average fertilizer usage per acre was 300 units nitrogen and 140 units of phosphate and potash.

At Dairy House Farm, also in 1967, a trial involving sixty Friesian steers was unfortunately brought to an end by foot-and-mouth disease in mid-November. Until that time the cattle had performed extremely well as is shown in the following figures:

Average weight at start of zero-grazing	22.3.67	469 lb
Average weight at start of barley feeding	22.8.67	827 lb
Average liveweight gain on grass alone		2·3 lb/head

These animals were maintained on 18·7 acres and zero-grazing was still going on in mid-November. Nitrogen usage per acre was 550 units. Ten of the cattle were sold fat at the end of September and a further twenty-four had been booked to go at the time of the foot-and-mouth disease outbreak. The remaining animals were also in a forward condition. No financial data could be produced for this trial but it is evident that had the trial been allowed to proceed to completion, the resulting gross margin would have been very high indeed.

However, gross margin is only half the financial picture and most people will immediately question the effect of zero-grazing on fixed costs. Without the context of a specific farm this is very difficult to answer. At Jealott's Hill and Dairy House the zero-grazed beef cattle require the use of a tractor, flail forage harvester and forage box for approximately 1½ hours per day and one man for 2 hours. However, the situation of these farms cannot be transposed directly on to commercial farms and the only logical way to arrive at the likely extra fixed costs in a commercial situation is to answer the following questions:

1. What extra machinery is needed?
2. What extra running costs will be incurred by existing machinery?
3. What extra labour is needed?
4. What extra overtime has to be worked by existing farm staff either to look after the zero-grazed beef or on other farm enterprises due to zero-grazing?
5. What building changes are necessary?
6. What expenses are saved, e.g., the provision of fencing and water supplies?

When the direct cost of labour and the depreciation and running costs of machinery and buildings have been costed, a net figure can be derived which can fairly be classed as the extra fixed costs attributable to the enterprise.

Trials such as the two reported above have shown that zero-grazing merits a thorough examination, but it should not for a minute be assumed that I.C.I. is now backing the system as the *sine qua non* of 18-month beef production. Much is still to be learned, particularly of the effect of weight at the start of the grazing season on performance, of ways of minimizing the fall in performance that tends to occur during prolonged spells of wet weather and the best ways of dealing with slurry. But the potential of the system is beginning to emerge and already some of the myths of zero-grazing have been dispelled: poaching is not prohibitive; the use of formic acid allows grass to be cut on Saturday for feeding the next day, thus eliminating the necessity to cut seven days per week; and machinery need not be elaborate

(a commercial farmer in Northern Ireland zero-grazes with a second-hand flail harvester and an ordinary silage trailer which is emptied into a simple self-feed bunker).

Work is to continue at Jealott's Hill and Dairy House and the results gained together with experience on Experimental Husbandry and commercial farms practising the system will enable a complete picture of the pros and cons of zero-grazing for beef production to be pieced together.

This article has been contributed by **B. Livesey, B.Sc. (Hons.), Agric.** who is Assistant to the Senior Farm Manager at the I.C.I.'s Jealott's Hill Research Station, Bracknell, Berks. Prior to taking up this post in 1968 he was in the Farm Management Advisory Section of the company.

Slaughter of Poultry Act 1967

The Slaughter of Poultry Act 1967 will come into operation on 1st January, 1970, and the Ministry of Agriculture, Fisheries and Food wish to remind those affected by the Act that they have now only one month in which to make sure they are able to comply with its provisions.

The Act applies to anyone who slaughters turkeys or domestic fowls for human consumption, on a large or small scale either regularly or just occasionally.

The Act requires that the birds must either be slaughtered instantaneously (by decapitation or dislocation of the neck) or, before being slaughtered, stunned by means of an instrument of a kind approved by Ministers, so that they remain insensible until they are dead. An approved instrument is an instrument which passes an electric current through the brain of the bird sufficient to render the bird instantaneously insensible to pain.

Premises where birds are stunned prior to slaughter must be registered with the local authority. Local authorities have power under the Act to enter premises, including those where a stunner is not used, for the purpose of checking whether the Act and any Regulations made under it are being observed.

Anyone who slaughters birds by decapitation or dislocation of the neck are not affected and they need do nothing. Those who slaughter by any other method must use an approved stunning instrument and have their premises registered with the local authority.

The Act exempts slaughter for the food of Jews by a Jew licensed by the Rabbinical Commission, or for the food of Muslims by a Muslim, from the requirement to stun. It permits no other exemption from stunning.

The County Agricultural Adviser for Cheshire discusses the problem of low solids-not-fat in milk during the wet seasons in his area

Solids-not-fat in Wet Seasons

R. Hope

MANY milk producers ran into trouble with low s.n.f. in the late winter months of 1967. This experience was widespread in the western half of the country and nowhere was the problem more severe than in the intensive milk producing areas of Cheshire.

Low s.n.f. in milk is no new problem here, and few winters pass without a number of cases arising. But in the winter of 1967 the problem was much worse than usual. So much so, that some dairies found a high proportion of their bulk milk supplies falling below 8·5 per cent s.n.f. In one instance the whole of the bulk supply fell to below this level in January and February. This indicated the extreme severity of the problem and the fact that it was widespread and not merely confined to a few farms. In the worst cases where s.n.f. fell to very low levels, dairies had to reject supplies which were then returned to the farms. This, of course, involved the farmers concerned in serious financial losses, over and above those due to subsequent lowering of the milk payment class.

Fluctuation of s.n.f. levels

The seasonal pattern in the s.n.f. content of milk is well known and every year there is a steady fall in the percentage from a high level in the autumn until a minimum is reached in the late winter months, after which there is usually a rapid recovery when cows are turned out to graze young spring grass. In some years the terminal levels reached are lower than usual and 1966/7 was one of these years. Above average rainfall fell in the summer and autumn months of 1966, and such weather conditions had a very adverse effect on the quality of fodder harvested for use in the winter of 1966/7. In

the 1966 summer not only were hay crops harvested at far too late a stage of growth for high nutritional quality but many crops suffered severely from weathering in the field. Silage makers fared better but poorer fermentations were often obtained in the wet conditions. Thus supplies of fodder for winter use were well below average feeding quality. The low feeding value of much of this fodder could possibly have been one of the reasons for the low s.n.f. milk produced in the winter.

Exceptionally wet weather was experienced in the autumn of that year and cattle are rarely at their best under these conditions. Grass in a wet autumn may be plentiful and yet be inadequate nutritionally. Not only is the dry matter of such grass lower than usual, but its digestibility and palatability is also low, even though it may show fairly high protein content on analysis. The result is often a markedly lower intake by the grazing animal. Low intakes are often accentuated too at this time of the year on pastures which have become fouled after several grazings during the summer, and by the fact that cows spend more time sheltering during rain storms.

The combination of poor quality fodder for winter keep and the reduced body condition of cows entering the winter after exceptionally wet autumn grazing conditions, was the main cause of the low s.n.f. content experienced later. An investigation of some 60 of the worst cases brought some interesting details to light.

In most cases the records showed that reasonable levels of s.n.f. were maintained throughout the year, only with difficulty, and in most years there was a tendency to drop below the 8·5 per cent standard in one or two months of the year, particularly in the late winter period. It seemed that the effect of wet summers on those farms were more than sufficient to reduce already rather low levels of s.n.f. to below the danger point.

In one district where many low s.n.f. problems were met it was found that about half of the herds were of high age. On average s.n.f. content of milk falls at the rate of about 0·1 per cent per lactation up to the fifth lactation after which the decline is less rapid. A high proportion of older cows in a herd can, therefore, have a very depressing effect on s.n.f. levels. An extreme case was that of a flying herd where cows of fourth calf or older were purchased.

Calving

Infertility which is also known to depress s.n.f. severely did not seem to be a prominent feature in the Cheshire herds, but there were a number of cases where the pattern of calving in the herd appeared to be the main cause of low s.n.f. levels in late winter. This occurred when there was a preponderance of autumn calvings, and is a result of an unfortunate combination of seasonal and stage of lactation effects on milk quality. In autumn calving herds the stage of lactation which gives lowest s.n.f. levels is apt to coincide with the seasonal depression occurring in January and March.

In most of the cases investigated hay was relied upon as the main winter feed and much of this hay was of inferior feeding value. The feeding of concentrates, however, was fairly liberal, but in spite of this it is doubtful whether the nutritional requirements of the cows were being adequately met, even though the feeding of concentrates at 4 lb or more for every gallon produced in the winter was a common practice. Analysis of hay that year showed that a starch equivalent of only 20–25 per cent was all that could be

expected from many samples. Such hays fed at the traditional 20 lb per day could not of course provide an adequate maintenance ration and meant that some of the production concentrates were being used for maintenance. In a few cases where the poor hay was supplemented by feeding an additional 4 lb of barley per cow per day, an improvement in s.n.f. was obtained. Supplementing poor hay rations in this way, however, failed to produce a response where underfeeding had been at all prolonged.

The level of concentrates feeding in relation to the yields of milk obtained did not at first sight suggest serious underfeeding. Typical examples were the feeding of 3·0 to 3·5 lb of concentrates per gallon of milk produced over the year, for yields of 800 gallons per cow at a stocking rate of 1½ acres per cow. Many would regard such concentrates feeding levels as generous or even extravagant. Yet even at these levels of feeding it is possible for cows to be inadequately fed if the contribution from the grassland on the farm is low.

Concentrates and starch equivalent

If at 3·0 lb per gallon the 2,400 lb of concentrates fed is credited with the production of 600 gallons of milk, this means that the 1½ acres of land must maintain the cow and produce 200 gallons of milk. It should be well within the capacity of most land to reach this comparatively low level of production of about 18 cwt of utilized starch equivalent per acre. Yet a grassland survey carried out in Cheshire in 1961 and 1962 showed that production from the fertile acres of the Cheshire plain could be quite low unless adequate fertilizer dressings were made. In that survey only 12 cwt of utilized starch equivalent was obtained where less than 20 units of nitrogen were applied. In these circumstances in spite of feeding concentrates at over 3·0 lb per gallon the nutritional requirements of a cow producing 800 gallons on 1½ acres of land could be deficient by about 9 cwt of *starch equivalent*. This represents serious underfeeding of some 20–25 per cent below the accepted standards, and could well result in low s.n.f. milk.

The same grassland survey showed that with more generous fertilizer use much higher production could be obtained and at application levels of 200 units nitrogen per acre a *utilized starch equivalent** output of 26 cwt per acre could be expected. At high nitrogen levels special conservation measures are necessary since the young, leafy grass produced by this rate of manuring cannot readily be made into traditional hay by ordinary field drying. Either barn drying techniques have to be adopted, or a silage-making system introduced. Strip or paddock grazing methods are also necessary to ensure good utilization of the extra grass produced. All in all, the adoption of such techniques means some major changes in farm organization, which may not be readily acceptable to all dairy farmers. Yet the alternative to intensive grassland management if these serious milk quality problems are to be successfully avoided, is to make good the nutritional deficiency by feeding extra concentrates. In most cases such a course would be likely to be quite uneconomic. The provision of an additional 9 cwt or so of *starch equivalent*

*This method of estimating output from a determined area of grass is based on the British Grassland Society's standards. This figure is obtained by calculating the theoretical starch equivalent requirement of the dairy stock and deducting from it any starch equivalent supplied as feed supplementary to the grass grazed.

The estimated S.E. of grass conserved in the form of hay or silage is added to that calculated as utilized for grazing to give the total output from the grassland.

in the form of concentrates might cost in the region of £20 and would reduce the margin per cow by this amount.

Grassland management

There is thus a strong case for the adoption of a more intensive grassland policy in these circumstances. That this should be necessary is all the more evident when the density of stocking is taken into account. The average stocking density for the whole county of Cheshire is 1·6 forage acres per livestock unit and it is significant that most trouble with low s.n.f. occurred in those areas of the county with the highest stocking rates, and in permanent grassland where nitrogen use is traditionally low.

While there are many factors which are known to influence the s.n.f. content of milk, experience in Cheshire indicates that the most important are—the age of the cows in herd, the calving pattern in relation to the season of the year and above all, the quality of the winter fodder. Fodder quality naturally suffers in wet summers, especially where reliance is mainly on hay, and the effect of poorer quality fodder is accentuated if the winter is preceded by an abnormally wet autumn.

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National Fruit Trials, Brogdale Farm, Faversham, Kent,
gives his impressions of the**

Ninth British Weed Control Conference

THE ninth conference of the British Weed Control Conference had a distinctly international flavour. It was attended by 1,011 delegates representing 25 countries in addition to Britain. Behind this is the fact that trade in agricultural chemicals is now a world-wide operation. The costs of discovering, developing formulations, securing clearance and arranging marketing of a new chemical are now so great that no company can undertake the task unless it is assured of a world-wide market for the product. Sir Frederick Bawden, Director of Rothamsted Experimental Station, in declaring the conference open, said that more publicity could well be given to the miracles which have now become commonplace in weed control. By a single spray, for example, a crop of field beans can now be kept weed free through the whole season. Field beans were formerly one of the farmer's most weedy crops: now they can be one of the cleanest.

As such matters as how to cope with resistant weeds, choosing the optimum weather conditions for spraying etc., come to the fore, the whole problem of weed control gets more complex, and the N.A.A.S. adviser will be called on to fill an increasingly important role in ensuring that the farmer or grower gets the best results in economic terms from the materials he uses. In cereal crops, particularly, it is the grass weeds (the more difficult weeds to kill) which are the most damaging to the crop, and the grower needs specialist advice. A further result has been the development by some agricultural merchants of specialized services which include advice to the farmer on choice of product and how and when to apply it, and one session of the conference was devoted to 'servicing the cereal grower'. As vegetable crops, especially those grown for processing or pre-packing, move out to farmland, horticultural advisers will need to be aware of the weed problems which farm crops have left behind in the soil, though in intensive crops the methods of tackling those weeds will be different from those used by the farmer.

Intensive crops

Mr. R. F. Clements, N.A.A.S. horticultural specialist with the Weed Research Organization, spoke of the way in which herbicides are influencing the whole scale of production in vegetable crops.

The area of onions being grown in the Holland division of Lincolnshire has increased over the last ten years by 12 per cent. One of the reasons for this is the availability of better herbicides and better drying facilities. The cost of weeding carrots has been reduced by modern weed-killers from 25 per cent to 10 per cent of the total cost of producing the crop.

Vegetable producers are likely to be confused by the number of different herbicides available; this shows the need for specialized advice and probably also for specialized crop spraying services. Indeed in some areas there are already contractors who offer a comprehensive service for the control of pests, diseases and weeds. The pace of discovery of new chemicals shows no signs of slackening, and competition between manufacturers will intensify, as patent rights on some established chemicals are due to expire over the next few years.

There have been revolutionary changes in farm crops now that ploughing and rotation of crops are no longer needed to control weeds, though rotation may still be needed for other reasons such as disease control. Some of the new techniques may be applicable to field grown vegetables. Brassicas could be planted or even direct-drilled into a sward that has been killed (or simply suppressed if the intention is for it to regenerate under the crop). Where it is possible to irrigate either before or after the application of a herbicide, weed control becomes more reliable. In this respect the well equipped vegetable grower is likely to have an advantage over the farmer.

New crops

Crops which are marginally economic may become profitable propositions if cheap and efficient means of weed control can be found; two examples of this discussed at the Conference were oil seed rape and maize for animal feeding. At present the former is a break crop for the corn grower rather than a cash crop. A similar range of materials is used for oil seed rape as on horticultural brassicas, which is mentioned later in this account. For maize,

atrazine has been the commonly used herbicide for some time. It carries with it, however, a risk of residues which will reduce the yield of most other crops that follow it. This danger is being overcome by using mixtures of atrazine and linuron in which the total amount of atrazine given per acre is reduced.

Vegetables

It is estimated that 50 per cent of horticultural brassicas are now direct-drilled. This calls for weed-killers which are highly selective, as rainfall after application may cause the herbicide to move down to the germinating seeds. Transplanted crops, in which roots are well below the surface are less likely to be damaged. Nine main herbicides for possible use on brassicas were discussed, two of which (Nos. C7019 and GS 14260) were as yet without common names. Mixtures of herbicides have also been tried.

Of the above nine materials those most widely found to be suitable were propachlor and trifluralin. The latter needs to be worked into the soil by rotary cultivation before sowing or planting and is particularly useful against chickweed, fat hen and fumitory. On the other hand, shepherd's purse and groundsel are resistant to this chemical but may be dealt with by propachlor. The choice of weed-killer thus largely depends on the weed species present and, in choosing the right material, it was felt that growers would need help from their N.A.A.S. adviser. Three further possible herbicides have had limited trials on brassicas.

Onions, as had already been observed, were a crop where weed control is particularly important, as noted from the fact that residual herbicides now used may cost the grower over £20 per acre.

The processing crops, peas and beans particularly, are another example of the importance of the weed-killers. In a weedy crop the harvesting machinery may be physically impeded and, worse still for the grower, the factory may refuse to accept a crop which is seriously contaminated with extraneous plant material which normal cleaning methods will not remove. On peas, the established material dinoseb must be used at post-emergence but a range of residual herbicides (mostly of the triazine group) can be applied either before or just after the crop emerges, and have given promising results.

Soft fruit

In strawberries, simazine is now the usual material for established plants but it may be damaging to young ones. It also fails to control knotgrass (*Polygonum aviculare*). The usual time of application of simazine is in autumn. Spring application is more risky and up till now the only safe material for spring use has been chloroxuron. Lenacil has, however, now been shown to be suitable for spring use. It is effective on a different range of weeds from chloroxuron, with the advantage that it controls knotgrass. Its chief disadvantage is that it does not work well in dry soil conditions but, nevertheless, it will doubtless find a place for use on strawberries and is already on the market. A still newer material, terbacil, is very effective against weeds, including perennials, but its margin of safety on strawberries is slight and it is doubtful whether it can be used on this crop, though for some bush and cane fruits it may be useful, and it is more effective than simazine against couch grass (*Agropyron repens*). It cannot be used on black currants, which are very sensitive to it, but may be used on raspberries and gooseberries. On black currants where couch is a problem, good results were reported from

dichlobenil. Another weed which may become of importance in cane and bush fruits regularly treated with simazine, is coltsfoot (*Tussilago farfara*). On raspberries any one of the three materials atrazine, bromacil or chlorthiamid were found to be effective against coltsfoot although they are likely only to supplement simazine, not to displace it, as the main herbicide, as they are all more expensive. Chlorthiamid, if used frequently, may leave residues which are harmful to subsequent crops.

Scientific aspects of weed-killers

Structure and selectivity of compounds. Two related subjects were considerd here—the groups of chemical compounds which show herbicidal activity, and the way in which these compounds act on the plant. Related to this is the fact that certain plants are able to de-toxify a particular compound. If one species of crop plant possesses this ability and others, including the weeds do not, the compound will be a highly selective herbicide for use on the particular crop concerned.

Ways in which herbicides act include:

Inhibition of *photosynthesis*, e.g., simazine
Inhibition of *respiration*, e.g., PCP, ioxynil
Interference with nucleic acid metabolism, e.g., 2, 4-D, MCPA

Studies of the way in which paraquat and diquat interfere with photosynthesis may even help in our understanding of the process of photosynthesis itself. Another process which has been elucidated is the defoliation of tropical trees by synthetic auxins. The reason for leaf abscission is the much increased production of ethylene from areas of the leaf which the herbicide contacts. Ethylene is probably the most physiologically active compound known in nature. It causes profound effects even in very small concentrations.

Weed biology. The fact that there was a section under this title shows that the weed experts do not confine themselves simply to chemical control methods. Just as a study of the life cycle of fungi has improved methods of disease control so the investigation of the methods of self-propagation employed by weeds helps in making our weed control programmes more effective. In couch grass it has been discovered that buds below the terminal bud mostly remain dormant and that its success as a weed depends on this characteristic. Any measures which cause all buds to grow and so exhaust the rhizome's food reserves would help growers to eradicate the weed more quickly.

An intriguing subject was the control of weeds by means of their natural enemies. Many of the noxious weeds of the newly settled countries U.S.A., Canada, Australia and New Zealand are plants introduced from Europe. Each of the above countries is concerned in research programmes now being conducted to find suitable organisms for introduction to the new habitat to control specific weeds which are of particular importance there. There are three laboratories in Western Europe (at Delemont in Switzerland, at Montpellier in France and Rome in Italy) which are engaged in this work. In addition, scientists in the U.S.S.R. are studying means of biological control of weeds which have been introduced to that country, especially of the ragweed (*Ambrosia*) which came to Russia from America and is an important cause of hay fever.

The success of biological control of prickly pear (*Opuntia*) in Australia is already well known. Another case in which control has been achieved is the

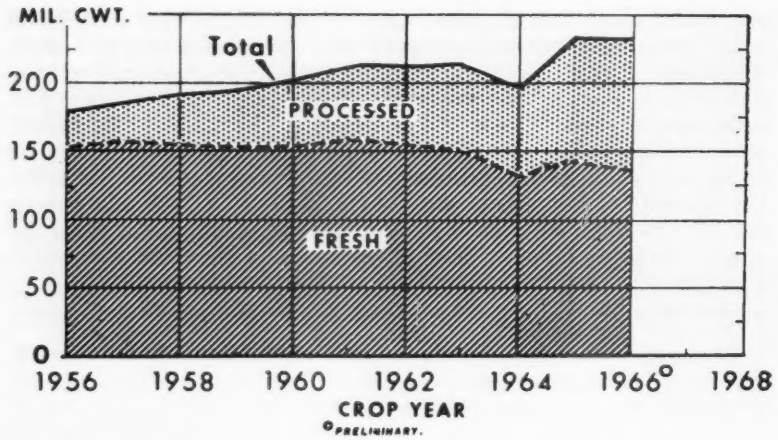
common St. John's wort (*Hypericum perforatum*), a serious weed in California which has now been reduced to 1 per cent of its former density by a beetle which feeds on it. The possibility of using the thistle insect to control creeping thistle (*Cirsium arvense*) in Britain is being considered. The advantage of such natural predators is that the weed does not acquire resistance with the passage of time in the way that it may acquire resistance to chemical control. Because of the latter effect we shall probably see the appearance of groups of weeds having resistance to particular races of chemicals. To counter this, growers and advisers will need to know more in detail of the properties of the full array of herbicides now becoming available, so that where resistance occurs a material with a different mode of action can be brought into play.

THE AUTHOR

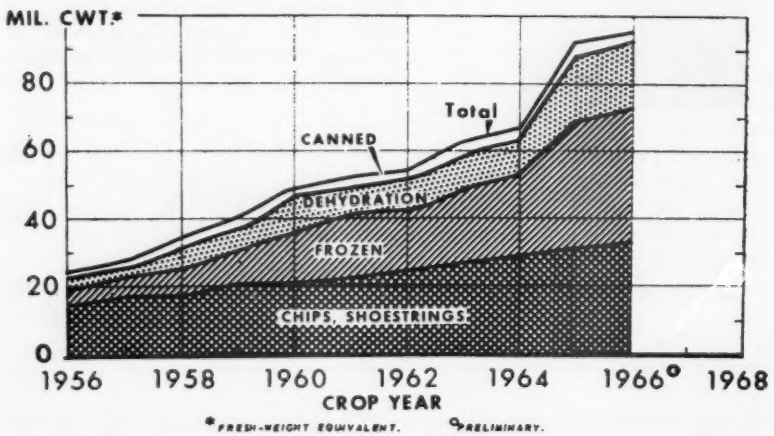
C. P. Hampson of the Potato Marketing Board discusses the type of potatoes that will be required in the future and what producers can do to meet the requirements of the processing industry

Processing Trends in Potato Production

ALTHOUGH there is nothing very new about potato processing, the many and varied products available on the supermarket shelves today are as different from the one or two products reminiscent of the last war as those were from the first processed potato products produced by Inca tribes of the Chilean Andes more than 2,000 years ago. The present revolution in potato processing also started across the Atlantic where, in the U.S.A., the proportion of potatoes used for domestic consumption in one processed form or another rose from 2 per cent in 1940 to 41 per cent in 1966, and it is estimated there that the proportion may reach nearly 50 per cent by 1970. The marked change in the pattern of household use of fresh and processed potatoes in the U.S.A. over the period 1956/1966 is as follows:



This indicates that although the consumption of fresh potatoes has declined, the overall consumption of fresh and processed potatoes has increased. The diagram below shows the increase in the quantity of potatoes used for the main processed potato products in the U.S.A. Up to 1964, crisps (or chips as they are called in the U.S.A.) accounted for the largest proportion of these products. Since 1964, however, frozen French fries have taken the lead and account for 36 per cent of them.



The trend in the consumption of fresh and processed potatoes in this country shows a similar pattern, with the fall in the consumption of fresh potatoes being more than compensated for by the increase in the consumption of processed potatoes. The proportion of potatoes which are processed in Britain for human consumption has increased from about 2·5 per cent in 1955 to 11 per cent today, and over the next five years it is estimated that this proportion may reach 25 per cent.

Last year (1968) approximately 630,000 tons of potatoes were consumed in Britain in the form of crisps, chips, instant mash, frozen French fries,

canned potatoes and other food products. By 1975 this figure may well be in excess of one million tons. It is most important, therefore, to consider what types of potatoes will be required in the future and what producers can do to meet the requirements of the potato processing industry.

Although the increase in the production of frozen French fries, dehydrated and canned potatoes has been very substantial over the past two years and considerably higher than the increase that has occurred in recent years in the production of crisps, the latter is likely to continue for some time to represent the major sector of the potato processing industry. It is estimated that the quantity of potatoes used for the production of crisps in Britain last crop season was of the order of 380,000 tons, and that by 1975 this figure may well be in excess of half a million tons.

So far as crisps are concerned, the need is for sound 'standard' grade potatoes which are free from serious mechanical damage and bruising and which have a relatively high dry matter (20–24 per cent) and low reducing sugar content (less than 0·25 per cent). The colour (i.e., the amount of browning) in crisps after frying is largely determined by the degree of chemical reaction undergone by the reducing sugars in the potatoes. Potatoes containing a high level of reducing sugars produce crisps which are unacceptably dark in colour and have a bitter taste, and developments are taking place in crisp frying techniques to try to overcome the problems associated with the use of potatoes of this kind. The undesirable dark colour develops during the last stages of the frying process and the time in and temperature of the frying oil are the critical factors in this reaction. Processes are now being developed, however, which enable the crisps to be removed from the hot frying oil at the critical point where they have lost the greater part of their water content and have not yet become too dark in colour. One of these involves micro-wave energy which enables the frying of the crisps to be completed very rapidly before they become too dark. Another technique being developed to achieve the same objective, is vacuum frying. It will be remembered that water boils at decreasingly lower temperatures as the atmospheric pressure is reduced and, because of this, it is possible to boil off the surplus water from the partly fried crisps by frying them under partial vacuum at a temperature below that at which the browning reaction occurs. Both these new frying techniques are being adopted and developed by crisp manufacturers in this country.

These processes will enable potatoes having a level of reducing sugars above the limit of acceptability for the current standard methods of production, to be used for crisp production. Notwithstanding this, however, nothing that has so far been devised will obviate the necessity for potatoes of the right quality. Dry matter content and low reducing sugar levels will continue to be important criteria of potato quality in relation to crisp manufacture for some time. It is right, therefore, that plant breeders should continue to breed for better crisping varieties. At the present time the variety Record, so far as maincrop potatoes are concerned, is used almost exclusively.

In certain years, however, this variety suffers in England from its susceptibility to bruising and internal black spot and in Scotland, from having an excessive reducing sugar content level at harvest time. The two recently introduced yellow-fleshed Dutch varieties Woudster and Thynia are superior to Record in terms of low reducing sugar content but they may be even more susceptible to bruising. Pentland Ivory is the only white-fleshed new variety which is of interest as a potential crisper but it produces tubers with

a higher level of reducing sugars than the yellow-fleshed varieties mentioned. It appears unlikely, therefore, that any variety will replace Record for crisping purposes over the next few years. The increase in the acreages of Record and the early variety Home Guard, also used for crisp manufacturing, is shown in the table below.

Increases in the acreages of potatoes used for crisping 1958–1968

	1958	*1963*	*1968*
Home Guard	16,388	16,516	21,669
Record	6,667	16,979	29,769

At the present time sales of frozen chips in Britain are next in importance in terms of potato usage and are expected to double over the next five years. Whilst American experience may give no more than a rough guide to possible future developments in this country, it is worth noting that frozen chips (French fries) are the leading frozen food product in the U.S.A. where more potatoes are now used for frozen chip manufacture than for crisping (see diagram on page 606). The comparable figures in Britain for 1968/69 (in terms of raw potatoes) were 100,000 tons for frozen chips and 380,000 tons for crisps. By 1974/75 the market for frozen potato products (mainly chips) and par-fries is expected to take up to at least 250,000 tons of potatoes.

For the production of frozen French fries, as for crisps, potatoes with a high dry matter content (20–24 per cent) are required, but since the product involves less frying than crisps a slightly higher sugar level is tolerated. The upper limit is about 0·4 per cent with an optimum level of 0·25 per cent. The variety most commonly used is Majestic. It is not ideal, being variable in quality and occasionally too deeply eyed, but it is very widely grown and gives the manufacturer a wide choice from which to select his raw material. Pentland Dell and Pentland Crown are also used extensively for the production of frozen French fries. The variety, Dr. Mackintosh, produces excellent chips but is very susceptible to diseases and internal bruising and does not store very well.

Dehydrated instant mash potatoes is another rapid growth market which currently uses about 100,000 tons of potatoes per year. This market is likely to continue expanding and by 1974/75 it is estimated that it may have reached 250,000 tons. The types of potatoes needed for the production of granules or flakes are those that will make a good-coloured, dry, fluffy-textured mash when reconstituted with water. To meet these requirements potatoes with a high dry matter (as high as possible and preferably not less than 20 per cent) and low reducing sugar (0·25 per cent) content are sought but, since manufacturers in this country have to compete with imported products, price of the raw material is the main criterion. From the aspect of quality, King Edward is probably the most suitable variety, followed by Red King, Redskin, Kerr's Pink and Red Craig's Royal.

Much interest is being shown at present in the market for canned potatoes. The consumption of these potatoes in Britain increased from about one million 12½oz cans in 1962 to over 70 million in 1968, and by 1974/75 it is estimated that the quantity will have more than doubled. This represents a considerable number of cans; the tonnage of potatoes involved, however, is considerably less than that used in connection with the production of

dehydrated potatoes or frozen French fries, In terms of potato tonnages it is estimated that about 25,000 tons of home and imported potatoes were used by the canners in this country in 1968/69 and it is considered that by 1974/75 something like 50,000 tons of potatoes will be canned here. Texture (i.e., firmness and freedom from sloughing), size, shape, colour and flavour are the most important characteristics of potatoes when canned. Arran Pilot and Maris Peer have given satisfactory products when canned; King Edward has also been found to be suitable when it is lifted in an immature state but later, at maturity, it produces tubers which tend to slough and disintegrate when canned.

It is extremely difficult to forecast what quantities of potatoes will be used by the different types of processors five years hence. The predictions that have been made must be regarded as no more than the personal opinions of the author. These are summarized in the following table:

Potatoes used for processed products in Great Britain
Estimated raw potato requirements from home crop

Product	*Crop season* 1968/69 (*tons*)	1974/75 (*tons*)
Crisps	380,000*	525,000
Frozen and part-fried chips	100,000	250,000
Dehydrated	75,000	250,000
Canned (new, small)	25,000*	50,000
Other canned and processed products (i.e., soups, fish cakes, etc.)	60,000	75,000

*These figures include some imported new potatoes used by crispers and canners

These figures suggest that by 1974/75 the processing industry will be using no less than 1·15 million tons of raw potatoes per year or about 25 per cent of that part of the home crop going for human consumption. Regardless of how accurate these estimates prove to be, however, it is clear that the market for processed potato products will continue to expand and it is of vital concern to the well-being of the industry that everything possible should be done to meet the requirements of the market.

Plant breeders and growers concerned with the raising of new varieties are making great efforts to produce potatoes that will meet the requirements of potato processors. This, however, takes a long time, and over the next five years these requirements will have to be met very largely by varieties already in use. It is important to consider, therefore, what more the commercial grower can do now, with existing varieties, to produce the quality of potatoes required by the different potato processors. Before considering this in relation to the different sectors of the processing market, it should be recognized that the major cause for complaint and rejection of potatoes for processing purposes is excessive mechanical damage. This problem could be greatly reduced with more thoughtful treatment and more careful handling of the crop. By the adoption of such techniques as chitted seed and early planting when soil conditions are suitable, and by the correct use of fertilizers to obtain the required maturity of the crop at lifting time, much could be done to reduce the damage susceptibility of the crop. Planting in wider rows and correct setting and adjustment of the harvester, and more

care during loading, would greatly reduce the amount of damage caused during the lifting and transportation of the crop. Similarly, the amount of internal bruising would be reduced if more care were taken to avoid the adverse effect of cold temperature conditions during the sorting and grading of the crop.

Reducing sugars and dry matter contents are the main intrinsic factors influencing the quality of potatoes for processing purposes. The significance of variety in relation to processing quality has been discussed. So has the importance of maturity in relation to the reduction of mechanical damage. Maturity is also important in relation to the quality characteristics, and the treatments advocated with reference to damage reduction are also relevant in relation to reducing sugars and dry matter. For the production of crisps, frozen and par-fried chips and instant mash potatoes, potatoes with low reducing sugar content and high dry matter are required. Reference has been made to fertilizer treatment and insofar as high dry matter and low reducing sugar contents are concerned, potash is particularly significant. A general recommendation on soils with a medium NPK status is 120 units of nitrogen, 120 units of phosphates and 180 units of potash. So far as the latter is concerned sulphate of potash is preferred to muriate as it produces tubers of a higher dry matter content.

The reducing sugar content of potatoes is also influenced by rough handling but more particularly by storage conditions. Under low temperature storage conditions reducing sugars tend to accumulate rapidly in the stored potatoes. To avoid this, potatoes for processing purposes should be stored at a temperature of about 10°C (50°F). To prevent the excessive sprout growth that occurs on potatoes stored at this temperature, a chemical sprout suppressant such as CIPC should be used.

In contrast to requirements for the other processing purposes mentioned, immature potatoes of low dry matter content (specific gravity 1·075) are required for canning purposes. Tuber size is also important and a range of 15 mm–35 mm ($\frac{5}{8}$ in.–1$\frac{3}{8}$ in.) has been widely quoted: beyond this point there is much disagreement. Some experts maintain that the only way to obtain anything resembling early potato flavour is to use early potatoes; others quote the example of baby beets to suggest that small, mature tubers from specially grown crops of a suitable variety may be equally acceptable. Tuber size may be controlled by spacing of the seed. In general, the closer the spacing the smaller will be the tubers at lifting. Planting and lifting loosely spaced crops presents many difficulties. In Lincolnshire, close planting has been achieved by using planters designed for bulbs. Good results have been claimed from shallow planting—maximum depth 3 in.—which tends to increase the number of tubers. Conventional ridges 28 in. apart with seed spaced at 6–9 in. apart, according to size, have proved better than the bed planting system. Studies on fertilizer treatments have indicated that a dressing providing 50 units of nitrogen, 75 of phosphate and 50 of potash per acre is probably the best for optimum canning quality.

The crop is usually ready for lifting about 65 days after planting. At that stage rapid changes in the composition of the tuber starts to take place and it is vital to stop the crop growing when it has reached the desired specific gravity. So far, canning potatoes have been lifted by elevator diggers and hand-picked, as most conventional harvesters have been designed to let through the smaller tubers.

Significant as the technical problems are, they are likely to be capable of solution once the information and technical 'know how' now available are more widely put into practice. But to encourage growers to apply new techniques and produce potatoes for specific purposes, they must be assured that they will obtain reasonable returns for their specially grown crops. This suggests that economic factors will, in the end, determine the extent to which the techniques will be put into practice. It is, however, of vital concern to all sectors of the industry that every effort should be made to find a solution to these technical and economical problems.

The Ministry's Publications

Since the list published in the November, 1969, issue of *Agriculture* (p. 579) the following publications have been issued.

FREE ISSUES

ADVISORY LEAFLETS

No. 241. Leaf Spot of Celery (Revised)

No. 450. Perennial Bindweeds (Revised)

SHORT TERM LEAFLETS

No. 12. Bulk Handling of Apples and Pears (Revised)
(Formerly Bulk Handling of Apples)

No. 91. Peas for Drying (New)
(Formerly Peas for Drying. A.L.357)

No. 92. Black Grass (New)
(Formerly Black Grass. A.L.522)

No. 95. Ammonia as a Fertilizer (New)

Single copies of the above free items are obtainable from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex. HA5 2DT.

'At the Farmer's Service' 1969/70

A wealth of information of interest to farmers in England and Wales is contained in the latest edition of 'At the Farmer's Service'.

This handy, pocket-sized booklet, issued annually by the Ministry of Agriculture, Fisheries and Food, describes the many services and facilities provided by the Ministry and gives details of the grants and subsidies which are available to farmers and growers. It also contains the addresses of the local offices of the Ministry and of other agricultural organizations.

Copies can be obtained, free, from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT, or from any of the Ministry's Divisional Offices.

The black peat fens are some of the most fertile soils in Britain

Soil Mixing to Preserve Fen Peats

J. Smith, B.A. (Hons.), of the Arthur Rickwood E.H.F. discusses the problems that land wastage presents to the fen farmer: also the progress being made in soil mixing to create an even, deep organic loam to permit root penetration.

THE black peat fens stretch from Norfolk through Cambridgeshire and Huntingdonshire, on into Lincolnshire, and are some of the most fertile soils in the British Isles. Their high organic matter content makes them ideally suited to an intensive arable system; earliness, free drainage, workability at all times of the year and freedom from clods and capping. They have, unfortunately, one disadvantage. They are wasting away, as shown by the differences between land, road and river levels in the area. Initially this wastage was simply the shrinkage of the spongy peat mass as water was withdrawn from it by the early arterial drainage schemes. In recent times real loss of soil material has taken place. This is a much slower but more insidious process whereby oxidation of plant remains leads to a lessening of the total volume of black soil overlying the various estuarine deposits. The more efficiently the land is drained and cultivated the faster is the wastage rate, and already this inexorable process has converted one-third of the original 345,000 acres of drained fen into what is now known as skirtland. Here the peat remnants, very little deeper than plough depth, are being diluted in a random manner with the unweathered clays, silt alluvia and sandy gravels underlying the peat top soil. It has been estimated that the loss of another 24 in. of peat in the next thirty years will see the conversion of three-quarters of today's peat soils into skirtland.

Drainage problems

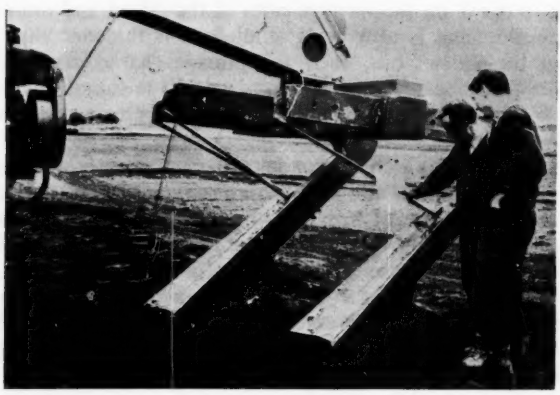
What problems does this present to the fen farmer? Essentially he will lose the very amenable and fertile top soil upon which the successful cultivations necessary for his high value cash crop system depend. As the soil surface falls nearer to unweathered mineral subsoil so does the ground water-table come nearer to the surface. Drainage problems, previously unknown in deep black fen, become acute and there is now a considerable

amount of investment annually in the laying of new underdrainage systems to supplement the original dykes and pumps. This is especially burdensome to the small farmer of which there are a high proportion in the fens. The undulations of the peat/subsoil interface cause further complications of the dry ridge/wet hollow situation found in fields where the peat is shallow. As these undulations come to within plough depth they will bring quantities of acid 'drummy' peat unevenly into the rooting zone of the crop, together with unweathered mineral subsoil, with extreme local variations in texture. As the proportion of this material increases in the cultivation layer very localized nutrient status, pH and soil management problems will arise.

Soil and machinery techniques

One of the main reasons for the setting up of the Arthur Rickwood E.H.F. was to investigate ways of living with this peat wastage, indeed of grasping the nettle and forestalling it if possible. In the Netherlands there is much experience of soil amelioration techniques and the machinery involved. This knowledge was gained at first hand by a visit to Holland of N.A.A.S. staff from the E.H.F. and Regional Soil Science Department early in the life of the farm. As a result, the soil mixing principle was chosen as most likely to fit the fen situation. It involves the mixing of the peat remnant with a similar depth of mineral subsoil. The aim is to create an even, deep organic loam free from undulating 'drummy' layers and zonal interfaces, which, in the present situation, tend to act as barriers to root penetration. The distribution of the peat throughout a greater profile depth will, it is hoped, reduce the overall wastage of these soils by removing some of the organic matter to a safer less well aerated zone.

In 1967 an implement became available which, it was hoped, would effectively carry out this accelerated mineralization. The implement, based on the subsoiler principle, was developed by Dr. A. N. Ede of the Unit for Land and Water Management Research, Cambridge (see photograph below). It consists of a massive box section toolbar carrying three staggered tines capable of working to a depth of four feet. Each tine has on its working face a dished blade, 18 in. wide at the bottom and tapering to 12 in. at the top. When



Subsoiler implement developed by Dr. A. N. Ede of Cambridge

this is drawn through the soil at an angle of 45 degrees the subsoil travels up the blade spilling off up the profile while the peat top soil falls into the cavities created. The tines are set at three feet apart and a bursting action is aimed at when the implement is in work.

Preliminary soil mixing studies, using a single blade prototype, were carried out on two soil types present on the experimental farm; sandy peat over compacted fine sand and loamy peat over silty clay. Both the sugar beet grown on the former, and cereals grown on the latter type showed a reduction in yield on the mixed plots. However, the reduced yield was lifted by extra nitrogen, more so in the cereals than in the beet. The responses to extra phosphate and potash were less well defined.

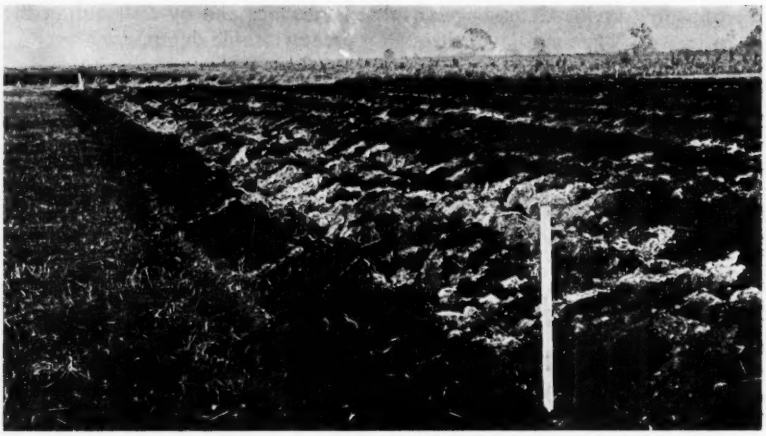
The start of the next phase of work, in co-operation with the Regional Soil Science Dept. saw the laying down of large-scale trials with the three bladed mixing subsoiler. Three sites were chosen, one on the experimental farm and two others on commercial farms in the fen area. The soil types chosen were 12–14 in. sandy peat over compacted fine sand on the experimental farm, 12–18 in. sandy peat overlying coarse sand at Hockwold, Norfolk, and 15–18 in. loamy peat overlying silty clay loam at Stowgate, near Spalding. The mixing treatments, carried out on replicated plots 0·2 to 0·4 acres in size, included a single pass deep mixing treatment to 32 in. A shallower mixing to 24 in. was also tried, to see if the disturbance of the interzone layers only was sufficient. For the same reason a deep subsoiling treatment was also laid down using the tines with the mixing blades removed. This was designed to burst the profile, without mixing, and to increase rooting depth. At every site, control plots were included and spare plots were left until such time as an alternative deep mixing implement, possibly of a rotary nature, became available.

Now these trials have been laid down, the object will be to assess the productivity of the mixed soils over a number of years. To this end for the next few years, nutrient level tests will be laid down across a part of the main trial area on whatever crop comes to the field as part of the particular farm rotation. In 1968, the first harvest year, the crops tested were potatoes, carrots and oats. The present crop year will give us results from one winter wheat and two sugar beet crops.

A comprehensive soil sampling programme has been carried out on all sites, both before and after mixing to ascertain the effectiveness of the mixing technique, and measurements of land levels will be made at intervals, as a check on the wastage rates of the mixed and unmixed soils. Crop root development is also being studied. It is intended that many other aspects of these new soils, such as drainage characteristics, microbiological and herbicidal activity, will be examined in due course.

What knowledge have we gained so far from the study of this relatively new field?

The mixing subsoiler was seen very clearly to bring subsoil into the surface layers on all sites (see photograph on p. 615) and subsequent profiles have shown the distribution of peat top soil, if in a rather uneven manner, down to the working depth. Soil analyses however, have shown that the mixing has not been as complete and to as great a depth as was hoped for, and that perhaps two passes at right angles might have been more suitable than a single pass. In all cases the subsoil exposed by the mixing has weathered well and has become well incorporated into the top soil as a result of normal farm operations.



The subsoiler clearly brings subsoil into the surface layer

Yields

The crop yields from all sites in 1968, the first harvest year of the trial, were very low. The short, cold and wet growing season that East Anglia experienced was the major factor here. The mixed soils gave depressed yields of all crops and this depression was not counteracted by additional fertilizer. In fact, the responses to additional nutrients in general were very small and variable. This depression in yields is not uncommon immediately after a soil disturbance of this magnitude and according to past experience a settling down period of a year of more is needed.

Root development studies on sugar beet have proved very interesting. It appears that on unmixed soils the tap root can penetrate the 'drummy' layer and continue down through the subsoil along old root channels. But during its passge through the 'drummy' layer it shows very contorted growth which must affect the early development of the beet plant. In the unmixed soils there were numerous horizontal laterals above the 'drummy' layer and a tendency for fanginess. These features were not nearly so marked on the mixed soils and the tap roots showed unimpeded growth down to three feet.

Future investigations

Much more recording has to be done over the next few years before we can know whether this soil mixing technique is an effective answer to the wastage problem. However, several points have already emerged. It is essential to have a detailed soil survey of a prospective site. This will show up undulations in the subsoil floor greater than 9 in., the maximum amplitude within which the mixing subsoiler can work effectively. If there is any suspicion of impeded drainage in the subsoil then a good underdrainage system must be installed before any soil mixing work is commenced.

In the future we would like to test any new soil mixing machines which become available. It is also intended to investigate shallow working techniques with a gyrotiller type of implement, working to eighteen inches. The aim would be to increase the rooting depth of the plant by disrupting

the impeding and undulating peat/subsoil interface and by distributing the infertile, acid 'drummy' layer through a greater profile depth.

Acknowledgement

None of this work would have been possible without the co-operation of the farmers who have made considerable areas of their land available. For this we are most grateful.

A Hundred Years of Seed Testing

J. R. Thomson, *President, International Seed Testing Association*

A HUNDRED years ago Friedrich Nobbe studied farm seeds at Tharandt, in what is now known as Eastern Germany, and was concerned to find that the seeds purchased by farmers were often of the wrong kind, badly contaminated with weeds, incapable of germinating or otherwise unfit for sowing. He worked out methods of testing seeds in the laboratory so that their field planting value could be forecast, and in 1869 established a laboratory to test seeds for the local seedsmen and farmers. From this small beginning the world-wide network of seed testing stations, which today monitor the quality of seeds as they pass along the chain from producer to sower, developed. Seed testing is now an essential control operation in the processing of seed which enables the farmer to buy seed of modern varieties with confidence, no matter in what part of the world it is produced.

The Centenary of Nobbe's innovation has been marked by a symposium held in September at Wurzburg in Germany, and the International Seed Testing Association has published a special issue of its Proceedings in which progress in seed testing is considered in relation to other developments in agriculture. Since the beginning tests have been mainly to determine specific purity and germination capacity, but novel techniques have been evolved in other fields such as cytology and plant health. A recent survey has shown that over ten million samples a year are being tested in official and semi-official seed testing stations; a surprising finding of this survey is that more than half the world's seed testing is done in Russia.

Alleviation at least, of Asia's chronic hunger is now in sight; new varieties of wheat and rice with short strong straw can bring the fruits of high fertilizer application right into the granary. The distribution of good seed of these varieties to farmers depends on the development of certification and seed testing projects, and in the underdeveloped countries FAO is actively engaged in this with the assistance of ISTA. What has already been done in India provides a model of what can be done elsewhere. Seed testing developed in Europe and North America and later in Australasia, and we might have expected some of the complacency of old age to be showing by now, but the needs of Asia, Africa and South America have provided a rejuvenating challenge to seed development in those areas.

29. West Monmouthshire

W. R. Dixon

THIS area, above all, is one of extremes, steeped in ancient and simmering in modern history. Topographically, it varies from mountain to coastal marsh, and the man-made range extends from small copse to large afforestation, really narrow country lane to motorway, genuine village to modern mass connurbation, and to top it off for good measure, an unnatural reservoir filled by massive pumps from the river Usk.

The district of West Monmouthshire is that part of the county west of the River Usk, northwards to Usk town, westwards to Pontypool and then north again to the heads of the Valleys, and in one-third of the county's registered holdings two-thirds of the hill farming is found. If any part of Monmouthshire appears to be Welsh (except when honour is at stake at Cardiff Arms Park), it is the upper part of this district, although little Welsh is spoken and even less is heard.

In the coastal belt west of Newport is an area called the Monmouthshire Moors—a description which northerners find quite ambiguous. The term implies lowland, in this case below the level of ordinary high tides from which it has been protected for some 200 years by a strong sea wall. The alluvial soil is naturally heavy and the generally small fields are divided by reens in which the water is either 'stanked up' or let go according to season and the wishes of whoever has the power of control. In this area, a ploughed field causes comment and some surprisingly good dairying is carried out amongst sheep and cattle rearing on accommodation land.

Drainage schemes involving mole and tile systems, and filling-in of unnecessary reens have, as yet, only touched the fringe of what is a real problem accentuated by the fragmented holdings that are a relic of the days when the area was summer grazing attached to farms on higher ground.

Just above the Moors and within striking distance of the two capitals, there is perhaps half of the county's serious horticulture, concentrating mainly on brassica crops, and, of course, within this area is the Ministry's Experimental Horticultural Station at Cleppa Park. Northwards and westwards the land takes its colour from Old Red Sandstone until the Coal Measures and Valleys proper are reached. Type of farming in the intermediate zone is just as much on inclination of the farmer as governed by the situation of the farm. With annual rainfall seldom below forty inches, it is grass which must be turned into money, and the size of the farm usually dictates

that dairying is the main enterprise, although as soon as the hill farming line is reached it is seldom that the opportunity for subsidy is ignored.

Farming in the Western Valleys is difficult, for one has to contend with climate, soil and mankind. In one or two areas it is still possible to see how green my valley once was, but these are sadly few and any undue romanticism is quickly dispelled by the sight of a river running black with coal dust. Farms become town and factory in a remarkably quick time. Like the Old Red Sandstone, these Coal Measures have their attendant deficiencies of trace elements and these assume particular significance when land reclamation and improvements are associated with more use of nitrogen and reseeding to simpler mixtures. Preventive measures can readily be taken but, unfortunately, not all are done soon enough.

Again dairying has its economic place up in the hills, and it is here that the small herds are found which bring the county average herd size down to twenty-five. Higher up the valleys the farming becomes less serious and the ultimate is the uptown ewe, living (does she need a rumen any more?) out of dustbins and gardens and sometimes using her turn of speed to escape the attentions of a juvenile air-gunned band.

Undoubtedly the area of greatest importance agriculturally is the central block bounded by the river, Caerleon, Pontypool, and to just north of Usk. This area predominantly on Old Red Sandstone includes some of the bigger farms in the county but few are over 500 acres. Dairying is naturally the mainstay and herd size and demand for additional lying and milking space increases monthly. The first bulk milk collection service started just over two years ago and this has had a great influence on cow numbers on many farms. This is not to ignore the place of cattle rearing, beef and sheep. With over one ewe to every acre of grassland, sheep flocks are a common sight and although output and income are low in comparison with cattle, there are many situations in which it is difficult to see the alternative. Of late, the returns from earlier lambing have influenced management considerably and the sight of lambs in this area is no harbinger of spring and daffodils for months to come. Unfortunately, cereal growing, in the county as a whole, is never as profitable as it should be, and it seems that the effect of fungus diseases is of more consequence here, possibly due to the climate than it is a few miles to the north.

The riverside land is noted for its effect on the growth rate of all stock and although Usk itself and a large part of the land below the town has suffered from flooding in the past, a long awaited flood prevention scheme is nearing completion. This, to the despair of anglers, has made a long stretch of river into a canal.

Agricultural education has a tradition going back to 1913 when at Usk the Monmouthshire Institute of Agriculture, now known as a College, was founded. It is one of the oldest in the country. Of particular importance is a Pig Supplementary Course, the only one of its kind, which is attracting a good intake of students as well as being of great interest to the pig industry.

Dairy Farming at High Land Prices

R. J. Rintoul *Agricultural Land Service, Taunton*

To farm your own land has long been regarded as a desirable aim towards independence and today, with all the pressures of modern living, such a way of life may seem attractive indeed. Farms to let are in short supply so that many intending farmers are forced to consider purchase at vacant possession values in competition with other potential buyers. Can such independence in farming really be justified or is the cost too high?

Financing

The price of agricultural land with vacant possession has been steadily rising over the past ten years, whilst the profitability of farming has tended to drop. During this period owner occupation has increased, although due to high capital outlay there are now signs of more farms being let. Much of this apparent anomaly can be explained by the desire of farmers on established holdings to profit by the economies of scale achieved by adding land at current prices as the opportunity arises.

During recent years it has become increasingly expensive to finance the purchase of an entire farm by a substantial mortgage and indeed, during the past few months, this has become virtually uneconomic due to the rapid rise in interest rates. Such a purchase today through the Agricultural Mortgage Corporation would incur an interest charge of 10¼ per cent. This means that on land in a predominantly dairying county such as Somerset costing £300 an acre, an annual charge of interest and capital repayments of about £20 per acre over a period of forty years would be incurred, assuming a mortgage of two-thirds of the purchase price is obtainable, disregarding funding expenses.

The Agricultural Mortgage Corporation will now accept repayment of a permanent mortgage loan by endowment assurance policy. If a 'with profits' policy is adopted, the guaranteed sum assured need only be 55 per cent of the loan, provided the sum assured with bonuses at maturity is equal to the mortgage loan. If it is deemed prudent to do so, it would be possible to cover the possibility of the endowment policy yielding insufficiently to repay the loan in the event of the early death of the insured by an additional life assurance policy. The income tax relief to which the purchaser is entitled will play an important part in the choice of repayment method,

and a prospective purchaser may well wish to seek professional advice on this aspect. But one important point to remember is that high capital repayments, on which there is no tax relief, will be incurred towards the end of the repayment period for a conventional mortgage.

Stocking rate

It is interesting to consider how a dairy farming policy might be planned to meet such an annual charge and, at the same time, provide a reasonable return on working capital. Of prime importance is stocking rate and this is influenced by such factors as situation, soil type, climate and standard of management. Over the past decade livestock numbers on dairy farms all over the country have been gradually rising. Whereas the average stocking density on holdings in Somerset may now be just under two acres per livestock unit (L.U.) a commonly accepted standard on many dairy farms is 1·5 acres/L.U. and, exceptionally, some farmers have achieved 1 acre/L.U.; or even less.

To achieve the maximum stocking rate per dairy cow it would be necessary to have the replacement heifers contract-reared off the farm, unless a flying herd policy was adopted. Depending on the size of farm, labour availability, soil and climatic factors, it may be good policy to introduce some high return cash cropping; for example, potatoes, in conjunction with a smaller dairy herd rather than aim at maximum cow density over the whole farm.

Financial returns

A minimum return of 15 per cent on working capital is now generally expected by farmers but this will be reduced where fixed charges are abnormally high as in the case of mortgage interest and repayments. The return may also be reduced where substantial capital expenditure is required on buildings. A return of 5–6 per cent should, in normal circumstances, be obtainable on total investment in land and buildings, cows and other working capital on a modern dairy farm stocked at the rate of 1·5 acres/L.U. but the return should be 10 per cent if the stocking rate is raised to one acre/L.U. assuming in both cases a gross margin of at least £85 a cow can be attained. These figures indicate the high level of management necessary to meet annual mortgage charges at current land prices. From the aspect of land ownership the return which may be expected by an owner-occupier on capital invested in land should reflect its true character as a long-term growth investment at, say 1–2 per cent. A return of this order has been acceptable on investments in farm land over a long period for social reasons not directly concerned with farming.

Leaseback

Circumstances may arise whereby a farmer finds himself unable to expand a potentially profitable enterprise through shortage of ready capital. Then he is faced with the necessity of incurring high interest charges on loans for this purpose. Alternatively, he may seek a purchaser for the farm subject to a leaseback agreement. Only the farmer can judge whether his need for ready capital justifies parting with the ownership of his land and the future benefits that might go with it. This sort of arrangement is becoming increasingly popular. However, the price paid in such cases will be some-

what less than vacant possession value to give the return of 4½–5 per cent required by the lessor. This arrangement would mean the owner parting with a growth investment which may conversely attract estate duty relief and involve a liability to capital gains tax. The ownership of a farm should not be disposed of lightly, such an asset is a valuable security for a loan which may be used to supplement working capital. In addition, it should be appreciated that the price of farmland in E.E.C. countries is considerably higher than similar land in Britain and this could well affect our land prices. Nevertheless, any increase in value since April 1965 will be subject to capital gains tax, the liability for which is likely to increase as time goes on.

Example

By way of example, we may consider a man aged 35 years who purchases a 100-acre farm at £300 an acre upon which he obtains a permanent mortgage of two-thirds of the purchase price from the Agricultural Mortgage Corporation. This will leave an equity to be found by the purchaser of £10,000. If working capital of £100 an acre, excluding any cost of new buildings, is needed, the total capital to be found by the prospective owner-occupier will be £20,000. The income and charges in these circumstances may be as follows:

	£	£
Dairy herd of 80 cows assuming a stocking rate of 1¼ acres/cow giving a gross margin of £85/cow assuming a herd average of 850 gallons		6,800
Deduct fixed costs:		
Labour (not charging farmer's labour but including casual)	1,000	
Machinery depreciation £6/acre	600	
Miscellaneous expenses £5/cow	400	
A.M.C. mortgage loan of £20,000 (excluding expenses) at 10¼ per cent interest	2,050*	
Endowment assurance policy, 'with profits' 30-year term for 55 per cent of the mortgage loan, i.e., £11,000, annual premium say	495†	
Cost of new buildings which will probably be necessary to accommodate additional cows: net cost after grant, say £6,000‡: annuity for repayment of principal over 15 years and interest at 10¼ per cent on outstanding balance	792	
		5,337
Net profit to cover owner-occupier's labour, management and investment		1,463

This gives a return of about 7¼ per cent on the total capital of £20,000 (excluding buildings) invested by the farmer and if he accepts a return of 1½ per cent on his capital invested in land (£10,000) this will leave a return on working capital of about 13 per cent. It should be emphasized that the

*This will be eligible for income tax relief for a limited period.
†This will attract income tax relief subject to certain restrictions.
‡This might be borrowed by means of improvement loan from the A.M.C or the Lands Improvement Company. The amount to be spent on buildings will vary from farm to farm and could be reduced by adapting existing buildings.

endowment assurance policy, assuming an average bonus declaration of 3½ per cent per annum compound based on the sum assured over the 30-year period, will produce a fund on maturity of £30,800, sufficient to write-off the mortgage loan with some to spare. If the conventional repayment of a mortgage of £20,000 over a period of 40 years was adopted this would involve the annual instalment of principal and interest of £2,088 resulting in a net profit of £1,920; in that event the return on working capital only would be 17½ per cent.

If the stocking rate were to be increased to one cow/acre it would be necessary to increase the working capital to say £12,000 making a total capital requirement for the owner-occupier of £22,000. The revised calculations would, in this instance, be as follows:

	£	£
Annual income		
100 cows at gross margin of £85		8,500
Deduct:		
Labour	1,000	
Machinery	600	
Miscellaneous	500	
A.M.C. costs as before	2,050	
Endowment assurance premium as before	495	
Cost of new buildings for 100 cows—say £7,500 net after grant		
Annuity on the same basis as before	990	
		5,635
	Net Profit	2,865

This gives about 13 per cent interest on the total capital invested of £22,000. Allocating 1½ per cent on the investment in land (£150) this gives about 23 per cent return on the working capital.

This article indicates that where land is being bought at current prices and interest of about 10 per cent paid on borrowed money, a low rate of return on the capital invested in land must be accepted but such an investment should give a long-term growth and also attract estate duty relief. Beyond these considerations, the aspiring owner-occupier may be content if the profit from his farming enterprise is sufficient to meet fixed charges, such as mortgage interest and insurance premium and still leave sufficient to cover personal needs.

Oxford Farming Conference

The theme for the twenty-fourth Oxford Farming Conference, to be held in the Town Hall, Oxford, from January 5th to 7th, 1970, will be **'The Challenge of the 70s'.**

The programme and full details are obtainable from the Hon. Secretary, M. H. R. Soper, O.B.E., Department of Agricultural Science, University of Oxford, Parks Road, Oxford, OX1 3PF. (Tel. 57245).

in brief

- **Small farm survey**
- **The Oldenburg**
- **Welsh National Agricultural College**

Small farm survey

UNDER the economic pressure of modern times increasing attention is being focused on the viability of the small farm. There is no question that among the ranks of small farmers may be found some of the most enterprising and skilful men setting an example of high output per acre well above the national average. With many others, however, farming less than 100 acres, the reverse is true: their earnings are commonly not higher than £750–£1,000 a year. Hence the government incentive to the amalgamation of holdings and the farmers' retirement scheme, which is aimed at facilitating a new farming structure with the minimum of social hardship. But what of the farmers concerned themselves? The question moves the emphasis out of the economists' court into the personal world of the individual farmer and his family.

It is this that the Farm Economics Branch of Cambridge University has been examining in a survey of two essentially different areas in eastern England, the Fens and Hertfordshire, and evaluated by Miss Ruth Gasson in an Occasional Paper, *Occupational Immobility of Small Farmers**. Though this has necessarily the limitations of any small investigation, there is no reason to suppose that the reaction of family farmers elsewhere under similar environmental and economic conditions would be markedly different.

If any evidence were needed that in certain circumstances farming is not so much a profession but more a way of life, this survey has provided it. Independence, an outdoor life and varied work are shown to have a stronger appeal than the opportunity of making more money, the attraction of shorter, regular hours and freedom from worry. Indeed more than half those questioned said they would go into farming again rather than take some other job offering a better finanical reward. Where farming is in the blood (and some three-quarters of the present generation of farmers in England and Wales originate from farming families) the idea of transferring the reins from father to son still plays an important part in small farmer thinking. The survey also found that the majority of young farmers, far from wanting to give up were satisfied with their occupation and were indeed keen to expand.

But the problem of making a living from those holdings which for one reason or another are demonstrably just incapable of being geared to present-day standards in their present form does not disappear with wishful thinking. It needs no crystal ball to foresee that the pace of re-structuring of British agriculture, already apparent, will gather momentum as we move into the 'seventies. As the report says, 'those who are sufficiently keen will always find the means to farm, and many will undoubtedly make a success of it. The danger is for those who miss other opportunities and drift into farming by default, only to realize the difficulties when it is too late'.

The Oldenburg

THE long-woolled Oldenburg of northern Germany is not widely known in Britain, but we may be hearing more of it if flock trials which have been proceeding on two

*Obtainable from the University, price 5*s.* 6*d.*

farms in south-east England and one in Lincolnshire produce hoped-for results. A first importation of fifteen ewes and four rams was authorized five years ago; now a second purchase, qualified by proposed breeding programmes, will widen the experience already gained. The University of Reading also has trials in progress aimed at evaluating the breed's merits *vis à vis* the Finnish Landrace.

As a pure-bred, the Oldenburg is a white-faced mutton sheep with a thick fleece, for the most part confined to the low-lying, traditionally agricultural area close to the border of Holland. It is of interest to note, however, that the breed carries some English blood, since as it is today it is descended from nineteenth century Cotswold and Leicester matings with the earlier indigenous animals to provide more meat for the rising industrial towns.

Experimental cross-breeding with Romney Marsh sheep has so far shown a higher lambing percentage, better lactation in the ewes, improved growth rate and a better wool clip. In Lincolnshire crossing the Oldenburg with Romney Half-breds is being tried out. Time and the close examination of carefully recorded data will decide whether there is indeed a place for the Oldenburg as an addition to our many British breeds.

Welsh National Agricultural College

The long-cherished ambition of the Welsh people to have their own national agricultural college is about to be realized. The Department of Education and Science has announced that work will start next spring on this project at Llanbadarn, just outside Aberystwyth. The first intake of students, it is anticipated, will be in 1971, and numbers will eventually be built up to around 200. Dr. D. W. Morris, who has had both research and commercial farming experience, has been appointed as its Principal.

The College, which will form part of a group of institutions of further education on the Llanbadarn campus and has sufficient agricultural land for use as a teaching farm, will cater for the type of farming found in Wales and will provide courses at a level between that of existing farm institutes and the university departments of agriculture. Courses will be offered at Higher National Diploma and Ordinary National Diploma levels in a range of agricultural and allied subjects, and may include those with a strong emphasis towards dairy farming, meat production, hill farming, farm management and marketing. The emphasis throughout will be on livestock and grass farming, primarily within the context of the family farm. Certainly, the location of the College is ideal for the study in depth of hill and mountain farming.

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books received

National Institute for Research in Dairying. Report 1968. University of Reading. 15*s*.

In-Store and Central Prepacking of Fresh Meat—Comparative Costs. Report No. 13. D. Lesser. University of Newcastle upon Tyne, 1969. 15*s*.

Classified List and International Register of Tulip Names. The Royal General Bulbgrowers' Society, 1969. Copies from the Society's Office, 45 Wilhelminastraat, Haarlem, Holland. 10 dutch gilders. (Approx. £1 3*s*. 1*d*.), plus postage.

Agricultural Research Council Annual Report 1968-69. H.M.S.O. 12*s*. 6*d*.

Land Use and the Constitution of Property. D. R. Denman. Cambridge University Press, 1969. 5*s*.

Hydrological Regions of New Zealand. Miscellaneous Hydrological Publication No. 4. C. Toebes and B. R. Palmer. Water and Soil Division of the Ministry of Works, Wellington, N.Z. 1969. (Price not yet available).

Books

Trade Liberalization and Canadian Agriculture. G. I. TRANT, D. I. MACFARLANE AND L. W. FISCHER. Oxford University Press, 1969. 33*s.* 6*d.*

This book is one of the series of twelve paper-bound volumes incorporating twenty studies on the implications for Canada of trade liberalization. The studies are being sponsored by the Atlantic Economic Studies Program of the Private Planning Association of Canada. The above volume comprises two studies; the first by Gerald I. Trant is an analysis of the competitiveness of Canadian agriculture and the second by David L. MacFarlane, and Lewis A. Fischer is an assessment of the prospects for liberalization of trade in agricultural products.

In the first study, Mr. Trant examines the competitive position of each of the major Canadian agricultural products in turn. In his conclusion he classifies the products into four groups. (1) Products in which Canada has a strong absolute advantage (mainly wheat, oats, barley and store cattle). (2) Products in which Canada has a slight absolute advantage (cheddar cheese and some pork products). (3) Products in which Canada has no ascertainable absolute advantage (mainly maize, beef, pork, eggs, liquid milk, tobacco and soya beans). (4) Products in which Canada has an absolute disadvantage (fruit and vegetables, sugar, poultry meat, butter and sheep products). There are no surprising items in these groups and the conclusions of this first section may be correct, but the analyses leading to them are not entirely convincing. For example, it is argued that Canada has an advantage over the United States in wheat production because yields are higher and, given relatively free trade in productive material inputs between Canada and the United States, land is the main fixed resource in wheat production and, therefore, yield per acre is a good indicator of efficiency of production. Taking this argument one step further the conclusion would be that Britain is approximately three times as efficient in wheat production as Canada. Also the analysis of Canada's competitiveness in cheese production ignores the fact—mentioned in the second study—that exports of Canadian cheddar cheese are subsidized.

The second part of the book comprises a statement of the general problem of freeing trade in agricultural products, a summary of agricultural policy in the E.E.C., the U.K. and other E.F.T.A. countries, U.S.A. and Canada, and a proposed strategy for reducing agricultural protection. The descriptions of the general problem and agricultural policies in the various countries provide a useful introduction to an appreciation of the difficulties facing policy makers.

Unfortunately, there are a number of factual errors, particularly in the section on the U.K. For example, it is stated that Government support to agriculture is equivalent to 70–80 per cent of net output whereas 30–40 per cent would be nearer the mark. Also, some play is made of the agreement which the U.K. has with overseas suppliers of grain. It is stated that this agreement dates from 1960 and includes an annual import quota: in fact the agreement was made in 1964 and there is no quota. Another criticism of the section on the U.K. is the assertion, without evidence, that the efficiency of agriculture has risen less rapidly in Britain than other countries. The rapid increase in labour productivity, which the authors concede, is put down to 'heavy new investments' but, again, no evidence is given.

In the foreword it is stated that 'despite the technical nature of much of the subject matter, the studies have been written in a language designed to appeal to the non-professional reader'. The result is a book which has the merit of being understandable to the layman, but which lacks the rigour of analysis that economists expect. A general criticism is that the statistics (and there are many) are out of date. The book was published in 1968 yet the latest year given in most of the tables is 1963–64 or 1964–65.

R.E.M.

Applied Animal Nutrition. (2nd Edition). E. W. CRAMPTON AND L. E. HARRIS. W. H. Freeman; 1969. £5

This well-known text-book of applied animal nutrition by Professor Crampton first appeared in 1956 and, in this second

edition, the strong North American flavour has been intensified by the co-authorship of Professor Harris of Utah State University. Written primarily for senior animal nutrition students, who presumably will already have covered a basic course of biochemistry, physiology and nutrition, it also aims at being a reference work for 'feed manufacturers, government research workers, agronomists, range managers, wildlife managers, agricultural economists and farmers'. The philosophy of approach to the subject is modern.

Biological energy is expressed in both the caloric and the TDN systems and the concept is proposed of expressing dietary requirements in terms of nutriment-to-calorie ratios. Quantitative data are given in both avoirdupois and metric systems, anticipating the early universal adoption of the latter, at least for scientific use. Feed nomenclature as standardized by the NRC in 1966 and now adopted for use in all NRC Tables of Feed Composition is clearly defined and used throughout the book and in the extensive tables in the appendix.

The text is divided into five major sections, preceded by a useful general summary of the subject matter of the various chapters comprising the sections 'What are Feedstuffs?', 'Nutritional Requirements of Animals', 'Nutritional Characteristics of Some Common Feeds', 'Ration Formulation' and 'Nutrient Needs of Animals', making up twenty-two chapters. Special chapters are devoted to linear programming and legislative aspects of feedingstuffs in both Canada and the U.S.A. Where appropriate, the subjects are treated in a mathematical manner but this extends little beyond simple arithmetic and algebra.

The authors have ranged widely in their selection of topics covered, so widely in fact that it is extremely doubtful whether the work as a whole could really be understood and appreciated by anyone with less than a detailed and competent knowledge of the principles of animal nutrition. For the remainder to whom the book is addressed, it is highly debatable whether they would make effective use of it other than as a reference work to particular topics, since an undefined but considerable basic knowledge of the subject is assumed.

It is not a student text-book in the sense of what students need to complement their courses of instruction (at least in this country) but it is a work that the specialized adviser and research worker could frequently consult with interest and profit. Nor is it a work for the agricultural economist, agronomist or practical farmer; too much basic knowledge is assumed of fundamental principles. It should be looked upon as a useful reference book, despite its high North American colouring and treatment. A few misprints were noted, but the plan of the work is very clearly arranged, there is a good index and, despite the lengthy manner in which they are set out, the tables of feed composition are both extensive and comprehensive.

A.E.

Sugar Beet Pests. (2nd Edition). Ministry of Agriculture, Fisheries and Food Bulletin No. 162. F. G. W. JONES AND R. A. DUNNING. H.M.S.O., 1969. 14*s.* (by post 14*s.* 10*d.*).

Sugar beet is a relative newcomer to the farming economy of Britain. Introduced only some 50 years ago, the acreage grown and its importance as a crop have increased rapidly. The control of pests is very important if serious crop losses are to be avoided. New methods of control have accompanied developments in methods of cultivation and a great amount of knowledge has accumulated during the past decade, largely as a result of investigations carried out at the Rothamsted and Broom's Barn Experimental Stations (the latter being supported by the Sugar Beet Research and Education Committee) in collaboration with the National Agricultural Advisory Service and the British Sugar Corporation Ltd.

The bulletin was first published in 1957 and this edition contains a great deal of new material: Docking disorder is extensively described in the eelworm section; the increasing importance of damage by bird pests has warranted the enlargement of the bird and mammal section; and there is an additional section dealing with troubles often confused with pest damage. Brief mention is made of foreign beet pests, and also of beneficial and other insects not harmful to beet crops. Although primarily concerned with pests of sugar beet, the bulletin deals also with mangel, fodder beet, red beet, spinach beet, chard and spinach.

The revision is a distillation of the author's long experience of the sugar beet crop, and again provides the grower and adviser with a comprehensive and well-illustrated guide to the identification and control of the various pests involved.

Cambridgeshire Customs and Folklore. ENID PORTER. Routledge and Kegan Paul, 1969. Five guineas.

Old beliefs and sayings that once passed for wisdom, old customs born of an indefinite past, old songs and stories that gave cohesion to early communities of man—this is the stuff of folklore and the bedrock of history. Though some linger on in ceremonials, sports and pastimes, and the odd superstition, they have for the most part disappeared with the maturing of modern society. It is, therefore, to books such as this that we are indebted for knowledge which would otherwise be lost.

Since Cambridgeshire is Miss Porter's home county, and she is the Curator of the Cambridge and County Folk Museum, she is particularly well qualified to have written this book, which rests on her countless first-hand interviews with local people and material supplied by that doyen of folklorists, Mr. W. H. Barrett. In its 400 pages there is much fascinating reading, embracing the lore and customs governing the circumstances of life from its inception to death, the superstitions associated with nature the traditional observances imposed by the calendar, games and recreation that softened the hardships of rural living and the customs of Cambridge University and the city's municipal and corporate life.

Remoteness of many parts of the fen country has understandably stimulated and perpetuated age-old beliefs rooted in nature, and in no sphere, as the author shows, is this more marked than in pregnancy and child-birth. Thus, sex was thought to be capable of pre-determination by the growth of parsley or rosemary in the garden, or the placing of a piece of horseradish underneath the pillows of husband and wife. The weather could be forecast by a cat's whiskers or the posture of a sleeping animal. And as recently as in the present decade a houseleek plant placed on the roof of a house was held by some to be an excellent protection against lightning. We may smile at such beliefs today, but if we are to see clearly the stepping stones of the past it is necessary to understand the psychology of the people.

Though some survive in attenuated form, the customs that attended successive seasons of the year, such as plough witching, straw bear dancing, the exchange of sprigs of may for a glass of ale, the festivities of harvest-time and similar bucolic simplicities, are now only a fading memory among the older folk.

Miss Porter is all too conscious of the treasure of Cambridgeshire folklore that still awaits its diligent researchers. 'Up and down the county', she says, 'are still many old and elderly whose memories should be recorded before it is too late, for with the deaths of such people a little bit of folklore dies, too, and our knowledge of tradition and custom is the poorer'. Her book, well illustrated and most usefully annotated, should prove to be a strong incentive to that end.

S.R.O'H.

Crop Technology. MAURICE EDDOWES. Hutchinson Educational, 1969. 50*s*.

The rapid adoption of increased mechanical and chemical power in crop production demands a re-appraisal of plant growth requirements and the means of attaining optimum growth conditions. This book attempts to relate modern concepts of plant science to current trends in arable farming. There are lucid explanations of growth analysis techniques. Competition among crop plants, together with the interaction of growth components, deservedly receives a good deal of attention. Throughout the book there is emphasis on the means of attaining maximum crop yield whilst minimizing unit costs.

The author is well known for his developmental work in maize and potatoes. These crops figure prominently in the illustrations of scientific principles of arable cropping but the problems and solutions tend to be geared to west midland conditions. Although cost control is stressed throughout the text the section on crop management has only limited acknowledgment of the significance of the organization of labour and power in determining profitability in crop production today.

The text is presented mainly in the form of lecture notes. Each chapter concludes with a carefully selected list of references to allow for more detailed study of the well summarized conclusions on recent research findings. Several figures and tables are presented to illustrate the more complex scientific expositions. This book is a useful modern guide to plant physiology with a thoroughly practical outlook covering the application of such knowledge in present day arable crop production methods.

R.G.H.

Agricultural Chemicals Approval Scheme

Eighth List of Additions to the 1969 List of Approved Products for Farmers and Growers

CHLORFENVINPHOS
Granular Formulations
Birlane GM—Shellstar
(for control of mushroom flies in mushroom compost)

DAZOMET
Dusts for incorporation in soil
Basamid—BASF

DINOSEB ACETATE alone
Liquid Formulations
Ivosit Emulsion—Hoechst

DISULFOTON
Granular Formulations
Solvirex F—Farm Protection
Solvirex F—Plant Protection
Solvirex F—Sandoz
Solvirex P—Farm Protection
Solvirex P—Sandoz

IOXYNIL with LINURON
A mainly contact herbicide with some residual action for selective weed control in spring barley and spring wheat.
Wettable Powder Formulations
Certrol-Lin—Hoechst

METHABENZTHIAZURON
A mainly soil acting herbicide for pre-emergence use to control black grass in winter wheat.
Wettable Powder Formulations
Tribunil—Baywood

METOXURON
A soil and foliar acting herbicide for post-emergence use to control black grass in winter barley and winter wheat.
Wettable Powder Formulations
Dosanex—Farm Protection
Dosanex—Sandoz

MONOLINURON with PARAQUAT
A contact and residual herbicide for the control of annual weeds pre-emergence in potatoes.
Liquid Formulations
Gramonol—Hoechst

PHORATE
Granular Formulations
Campbell's Phorate—Campbell

PROPHAM with FENURON and CHLORPROPHAM
Liquid Formulations
Premalox—May and Baker

Change of Product Name

CHLORPROPHAM with FENURON and MONOLINURON

The product announced in the 'Third List of Additions, to the 1969 List of Approved Products' under the name MONOTEX is now called MOLINEX

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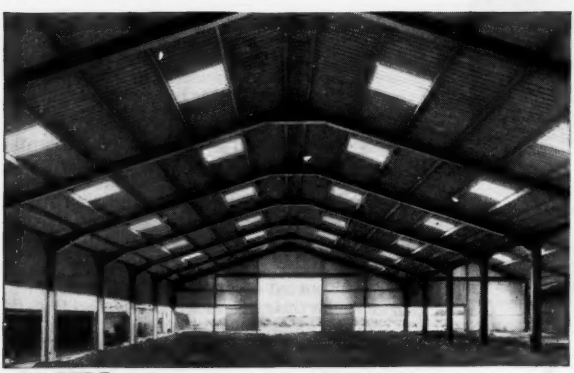

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